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SCHOENE (F.). **Combating the leaf spot disease.**—*Zbl. Zuckerindustr.*, xlviii, p. 20, p. 314, 1940. [German. Abs. in *Facts ab. Sugar*, xxxv, 9, p. 35, 1940.]

Beets were sprayed with a 1 per cent. solution of neu, a Bayer copper-lime product [*R.A.M.*, xviii, p. 649], on 8th July, 19th August, and 8th September, [? 1939], for the control of leaf spot (*Cercospora*) [*beticola*: ibid., xix, p. 688], the experiment being divided into three sections (1) controls, (2) only the upper sides of leaves sprayed, and (3) both sides treated. The following yields were obtained: (1) controls, 8th July, beets, leaves, and sugar, 344, 224, and 44·8 q. per ha., respectively; 19th August, 370, 228, and 57 q. per ha., respectively; 8th September, 352, 306, and 59·2 q. per ha., respectively; (2) upper sides sprayed, 8th July, beets, leaves, and sugar, 340, 313·6, and 46 q. per ha., respectively; 19th August, beets and leaves, 428 and 352 q. per ha., respectively (no third application); (3) both sides treated, 8th July, beets, leaves, and sugar, 370, 320, and 57 q. per ha., respectively; 19th August, 403, 344, and 57 q. per ha., respectively; 8th September, 390, 306, and 68·2 q. per ha., respectively.

While the generally beneficial effect of fungicidal treatment emerges clearly from these data, no definite advantage from spraying both leaf surfaces is demonstrated.

Annual Reports of the Department of Agriculture for the year ending 30th June, 1939. Economic Botanist's Report.—*New Guinea agric. Gaz.*, vi, 2, pp. 13–19, 1940.

In this report (by R. E. P. Dwyer) the author states that wilt of mature coco-nut palms on deltaic and estuarine deposits of the mainland of New Guinea, though associated with many fungi, such as *Thielaviopsis* [*Ceratostomella*] *paradoxa*, *Botryodiplodia*, and *Fusarium* spp., etc., is due primarily to adverse soil conditions [*R.A.M.*, xix, p. 531]. The study of soil profiles has yielded much information as to the suitability of different localities for coco-nut cultivation where chemical data are unobtainable. It has become apparent that detailed chemical and botanical research on the nutrition of coco-nut palms in relation to soil factors is essential.

In a case of true bud rot, *Phytophthora palmivora* [loc. cit.] was obtained almost in pure culture from the central tissue of the lower trunk. The disease developed in one property in a rainy area of flats

and foothills during an abnormally wet season, but only on heavy soil. As the fungus develops only in a very moist atmosphere, other properties are unlikely to become affected. *P. palmivora* is widespread in New Guinea, where numerous hosts besides coco-nut are present; apparently, therefore, it causes serious losses to coco-nuts only under special circumstances, probably not unless a virulent strain is present. Active steps are being taken to control the disease.

On one coffee plantation, improved sanitation has reduced the formerly destructive thread blight (*Corticium koleroga*), die-back (*Diplodia* sp.), and root rot [ibid., xvi, p. 657] to a minimum.

Infection of leaf tobacco by *Cercospora nicotianae* was sufficiently severe to reduce the value for native use.

Report of the Low Temperature Research Laboratory, Capetown, 1938–1939.—180 pp., 20 figs., 39 graphs, 1940.

In this report [cf. *R.A.M.*, xix, p. 286] J. E. VAN DER PLANK and G. F. VAN WYK (pp. 43–47) describe the preparation of tablets for the release of sulphur dioxide in packages of stored table grapes [against *Botrytis cinerea*]. The tablets are prepared from dehydrated alum and anhydrous sodium bisulphite with the addition of a little spermaceti to control the absorption of water vapour and act as a granulating agent. Analytical data are presented on the release of the gas under various conditions.

J. M. RATTRAY (pp. 48–60) gives details of tests in which table grapes of four varieties were stored for 20 to 21 days at 34° F., other lots undergoing a further storage period of ten days at 50°, the following treatments being given: (*a*) control, bunches wrapped in ordinary sulphite tissue paper, (*b*) control, bunches in waxed crystalline paper, (*c*) one sodium bisulphite-alum tablet (containing 0·22 gm. sodium bisulphite) packed with each bunch, the bunches being wrapped in sulphite tissue paper, (*d*) two tablets with each bunch, sulphite tissue paper, (*e*) as (*c*), but waxed crystalline paper, (*f*) one tablet (0·12 gm. sodium bisulphite) with each bunch, using sulphite tissue paper, and (*g*) as (*f*), using waxed crystalline paper. The results obtained [details of which are tabulated] showed that when the bunches were wrapped in sulphite tissue paper *Botrytis* and other fungal wastage (chiefly *Penicillium* sp.) was much reduced by all three concentrations of sodium bisulphite, and no sound fruit of any variety was injured by the treatment, but when waxed crystalline paper was used, while wastage was also effectively reduced, bleaching by the sulphur dioxide was caused. With either type of wrapping, the treatment also greatly reduced infection at 'loose' necks, and retarded desiccation of the stems. Thus, to give a few representative figures, after 20 days at 34°, lot (*c*) averaged 0·39 per cent. *Botrytis* waste and 0·15 per cent. other fungal waste, 0·58 per cent. loose neck, and 56 per cent. with green stems, the corresponding percentages for lot (*d*) being 0·34, 0·04, 0·31, and 64, and for lot (*f*) 0·51, 0·1, 0·88, and 59·0, while for control (*a*) they were 0·51, 0·22, 1·47, and 40, respectively. The figures for lots (*g*) and (*e*), with crystalline paper, were, respectively, 0·14, 0·04, 0·06, 99 and 0·33, 0·01, 0·01, and 100, while for lot (*b*), control, crystalline paper, they were 1·8, 0·31, 1·5, and 99. After a further 10 days at 50°, the percentages

affected in lot (*c*) were 1·29, 0·47, 0·9, and 29, and in lot (*d*) 0·95, 0·21, 1·16, and 35, respectively, as compared with 3·27, 0·82, 2·3, and 25 for control lot (*a*). Chemical analysis showed that the highest amount of sulphur dioxide found in grapes packed with 0·12 and 0·22 gm. sodium bisulphite did not exceed 5 parts per million, an amount well within the tolerance limit of 350 p.p.m. allowed by the Ministry of Health.

E. Beyers (pp. 60–63) adduces evidence demonstrating that the process of girdling the fruit canes one month after flowering markedly reduced the susceptibility of Waltham Cross grape vines to fruit shedding, the advantage of the practice being clearly apparent when the fruit was exposed to unfavourable storage conditions. The same worker (pp. 64–66) also showed that irrigation of Waltham Cross grape vines in an area liable to drought reduced susceptibility to 'drop berry' and stalk desiccation in storage.

J. M. Rattray (pp. 66–70) describes experiments which showed that waxing Honeydew melons before storage failed to control fungal wastage [unspecified] at 35° F., and accelerated it at 45° and 65°. The process also resulted in pitting at 35° and 45° (though not at 65°), and retarded ripening. Wastage was not controlled, at the concentrations used, by various fungicides incorporated in wax emulsions, but copper sulphate-starch paste containing 5 per cent. copper sulphate gave some control of stem-end rot [cf. ibid., xvii, p. 154].

W. E. Isaac and W. W. Boyes (pp. 78–88) show that Granny Smith apples after three months' storage at 31°, 34°, and 37° and held for a week at 65° had, respectively, 28, 25, and only 4·8 per cent. superficial scald. After four months, incidence was much higher at 31° (68·8 per cent.) than at 34° (53·6) and higher at 34° than at 37° (22·4), this relationship being maintained throughout the seven months the experiment lasted. At 31° and 34° (but not at 37°) a marked rise in incidence occurred between the end of the third and fourth months. Three weeks' delay before storage had no significant or consistent effect on scald incidence. Oiled wrappers considerably reduced the number of scalded apples (as compared with ordinary wrappers) during six months' storage at 34° and 37°, but at 31° their effectiveness was much decreased after four months.

J. E. van der Plank and J. M. Rattray (p. 88) state that the addition of ortho-phenylphenol to cultures on potato dextrose agar at 65° inhibited the growth of *Alternaria citri*, *Colletotrichum gloeosporioides*, *Diplodia natalensis*, *Phomopsis* [*Diaporthe*] *citri*, and *Sclerotinia libertiana* [*S. sclerotiorum*] at 0·005 to 0·01 per cent., *Penicillium digitatum* at 0·002 to 0·003 per cent., *P. italicum* at 0·01 to 0·02 per cent., and *Trichoderma lignorum* [*T. viride*: ibid., xviii, p. 761] at 0·002 to 0·005 per cent. The specific difference between *P. digitatum* and *P. italicum* is noteworthy.

In further tests by J. E. van der Plank and J. M. Rattray (pp. 88–93) of the storage of citrus fruits in wrappers impregnated with ortho-phenylphenol, employing lower concentrations than those used in the earlier experiments [ibid., xix, pp. 288, 590], lemons from Mataffin picked at a silver to yellow stage and stored for 28 days at 40° and then for 14 days at 65° developed 1·3 per cent. mould (mostly *P. digitatum*) and 0·3 per cent. other rots [unspecified] when packed in wraps

containing 14·6 mg. of the chemical per sq. ft. of wrap, as against 3·1 per cent. mould and 0·2 per cent. other rots when the concentration was 8·7 mg., and 9·9 per cent. mould and 0·5 per cent. other rots for the controls. The higher concentration of the chemical resulted in 5·2 per cent. injury (1·6 per cent. moderate to severe) and the lower in 0·6 per cent. (0·1 per cent. moderate to severe). With a second consignment from Karino the higher concentration of chemical alone was used, and gave 0·8 per cent. mould and 0·6 per cent. other rots, as against 5·4 per cent. mould and 0·6 per cent. other rots for the controls, injury due to the chemical amounting to 16·6 per cent. (2·3 per cent. moderate to severe). In a third test, lemons from Groot Drakenstein were stored, wrapped and unwrapped, for 54 days at 60° in boxes lined with waxed crystalline paper. The resulting figures were, for the higher concentration of chemical, 0·2 per cent. mouldy or completely rotten fruits and 0·1 per cent. infection by *T. viride*, the corresponding figures for the lower concentration being 0·1 and 0·2 per cent., and for the controls, 2·3 and 5·8 per cent., respectively. The higher concentration caused 54·6 per cent. injury (3·1 per cent. moderate to severe), and the lower 2·2 per cent. (0·1 per cent. moderate to severe). *T. viride* spread vigorously by contact in the controls, but its progress was almost completely arrested by the impregnated wraps. The humid conditions in the box caused the buttons to become infected and unsightly and to tend to fall off, but the fruits in the impregnated wraps were unaffected, and at the conclusion of the experiment appeared as if newly picked. In further tests, injury due to the chemical was greatly reduced by the addition of glyceride oils to the wrappers.

The same authors (pp. 93–98) found that ortho-phenylphenol was considerably more injurious to the rind of oranges than equivalent concentrations of its sodium salt. Used as a disinfectant for oranges inoculated with *P. digitatum*, ortho-phenylphenol was more effective than equivalent concentrations of sodium ortho-phenylphenate, which was even less effective when alkali was added to prevent hydrolysis; in practice, however, the greater potency of the ortho-phenylphenol was more than offset by its stronger tendency to cause rind injury.

Work by J. E. VAN DER PLANK (pp. 98–103) showed that a suitable bleaching solution for the treatment of citrus fruits affected with sooty blotch [*Gloeodes pomigena*: ibid., xix, p. 401] may be made by mixing chloride of lime and sodium bicarbonate. Bleaching solutions prepared with sodium bicarbonate are considerably more reactive than eusol, which is borate-buffered at too low an acidity for the release of any considerable quantities of free hypochlorous acid. For commercial use a ratio of sodium bicarbonate to Tropical chloride of lime, supplied by I.C.I. (General Chemicals) Ltd., Widnes, Lancs., England, of about 0·75 is advised. As bleaching solutions so prepared are unstable, especially when the available chlorine is over 0·2 per cent., they must be used immediately. The bleaching time required (at 16° C.) for chloride of lime solutions containing 0·33 per cent. available chlorine ranged from three to five hours when no sodium bicarbonate was used (P_H 11·8) to 35 seconds when the ratio sodium bicarbonate : chloride of lime was 2 (P_H 7·45).

In further investigations by J. E. VAN DER PLANK, J. M. RATTRAY,

and P. A. Crous (pp. 110–112) on the storage of lemons temperatures as low as 40° F. slightly retarded decay; fruits from Groot Drakenstein stored at 40°, 50°, 55°, 60°, and 70° showed, after 27 days, 0·2, 1·2, 2·9, 1·4, and 4·2 per cent. waste due to mould (mainly *P. digitatum*) and other waste (chiefly *Colletotrichum* [*gloeosporioides*]). The advantage was, however, only transitory. On exposure to warm temperatures, fruit stored at 40° decayed at a slightly faster rate than that stored at higher temperatures. Maturity at picking greatly affected decay, the riper fruits being more susceptible. For instance, lemons from Mataffin picked in the green stage, after storage for 28 days at 40°, 45°, 50°, and 55° showed, respectively, 0·8, 0·3, 1·5, and 1·5 per cent. total waste, the corresponding figures after the further 14 days at 65° being 2·6, 1·4, 1·6, and 1·9 per cent. Fruits from the same locality picked in the silver to yellow stage and stored at 40° and 50° for 28 days showed 3·1 and 4 per cent. total waste, respectively, the corresponding figures after a further 14 days at 65° being 10·4 and 7·4 per cent.; with both stages of maturity, the mould was entirely *P. digitatum*. Lemons from Karino stored for 4 weeks at 50° showed 0·4 per cent. wastage for the greener stage and 2·2 per cent. for the riper. Lemons from Rustenburg picked in the green, intermediate, and ripe stages, and stored for four weeks at 50° showed, respectively, 0·1, 0·2, and 0·8 per cent. total wastage, stem-end rots being the chief cause of decay.

Lemons stored for 28 days at 40° to 70° in lined and unlined boxes averaged, respectively, 2·5 and 1·2 per cent. waste, mostly *P. digitatum*. In one lined box at 60° *S. sclerotiorum* spread by contact, and in another at 70°, *Botrytis* sp. was present, both fungi being rarely found on South African citrus fruits. Another consignment stored in lined and unlined boxes for 54 days at 60° showed 8·1 and 2·5 per cent. total waste, respectively. The increased waste in the lined boxes was due primarily to stem-end and lateral rotting caused mainly by *T. viride*, which spread vigorously by contact.

J. E. van der Plank and J. M. Rattray (pp. 124–125) show that in tests with stored Navel oranges from Rustenburg, the removal of fruits infected with *P. digitatum* did not affect the subsequent development of decay, this result indicating that infection did not progress by contact.

D'Oliveira (B.). **Aspectos actuais do problema das ferrugens.** [Present-day aspects of the rust problem.]—*Palestras agron.*, ii, 2, pp. 5–77, 6 pl., 2 figs., 3 diags., 5 graphs, 1940.

This is a comprehensive survey of the literature from 1890 to 1939 on various aspects of the problem of rust diseases in plants, most of the more recent papers cited in the 11-page bibliography having been noticed from time to time in this *Review*. Incidentally, the author touches on certain questions of special interest in Portugal. In the central and southern regions of the country, the aecidial stage of *Puccinia coronata* is formed on *Rhamnus alaternus*, which was readily infected with material taken from plants of the genera *Avena*, *Arrhenatherum*, *Lolium*, *Bromus*, and *Holcus*, showing the inconsistency of systems of classification of varieties based on host relationships. Portugal further appears to harbour some special forms having no connexion

with those described from other countries. For instance, aecidia of *P. graminis secalis* on *Anchusa officinalis* yielded races which were found to be specialized on wheat, *Bromus rigidus*, and rye. Aecidiospores from *A.* spp., collected in Serpa and Ferreira do Alentejo, infected wheat but not rye, while those of *A. officinalis* at Belém attacked wheat, rye, *Aegilops*, and *Bromus*. Uredospore pustules on wheat, rye, and *Aegilops* were produced by inoculum from *Anchusa* spp. in Odemira. *P. g. secalis* was also successfully inoculated into *Echium tuberculatum* and *E.* sp., not hitherto recorded as hosts of this rust, while *E. plantagineum*, *E. tuberculatum*, *E. pomponium*, *A. sempervirens*, and two species of *Cynoglossum* reacted positively to *P. triticina* from *Aegilops ovata*.

Discussing the various forms of resistance to rust [*R.A.M.*, xv, p. 635] in relation to breeding cereals in Portugal, the writer points out that, in the case of *P. graminis*, which appears during or after earing, the development of the morphological type should be attempted, whereas resistance to *P. glumarum*, *P. triticina* (in wheat), *P. anomala* (in barley), and *P. coronata* (in oats) should be based on protoplasmic characters, since the yellow rust frequently occurs too early in the season for morphological resistance to be complete, while the others produce their aecidia in the autumn, and the climate imposes no thermal limitations to their development during the earing period.

NEWTON (MARGARET), JOHNSON (T.), & PETURSON (B.). **Seedling reactions of Wheat varieties to stem rust and leaf rust and of Oat varieties to stem rust and crown rust.**—*Canad. J. Res.*, Sect. C, xviii, 10, pp. 489–506, 1940.

The reactions of various wheat varieties to 20 physiologic races of stem rust (*Puccinia graminis tritici*) [*R.A.M.*, xix, p. 647] and 8 of leaf rust (*P. triticina*), and of oat varieties to 11 races of stem rust (*P. graminis avenae*) [ibid., xix, p. 526] and 9 of crown rust (*P. coronata avenae*) [loc. cit.] were studied at Winnipeg, Manitoba. In the *vulgare* group, the varieties McMurachy, Eureka, and several strains received from Kenya [ibid., xix, p. 394] proved to be immune in the seedling stage from all races of stem rust used, when kept at ordinary greenhouse temperatures (varying from about 55° F. at night to 80° by day). This immunity, however, largely disappeared at constant temperatures of 75° to 80°. In the non-*vulgare* group, only Iumillo and Iumillo × Mindum showed immunity and when Iumillo was tested at 75° to 80° its immunity was occasionally modified to moderate resistance. Several other non-*vulgare* varieties, such as Pentad, Belaturka, Khapli, Black Persian, and *Triticum timopheevi*, were highly resistant to stem rust at ordinary greenhouse temperatures. Considerable resistance to leaf rust was shown by the wheat variety Illinois No. 1B.8 and certain derivatives of the crosses Warden × Hybrid English, Chinese × Progress, and Chinese × Emmer, which were also shown to maintain their resistance when subjected as adult plants to a rather severe artificially induced epidemic in the field. Moderate resistance was shown by Carina, Brevit, Webster, Hope, H.44, and various derivatives of the two last-named. None of the *vulgare* varieties tested was immune from,

or highly resistant to, both stem and leaf rusts, the most promising in this respect being *T. timopheevi* and Iumillo.

Four oat varieties derived from the cross Hajira × Joanette proved to be resistant or moderately so to all races of stem rust used, and certain strains derived from the crosses Hajira × Banner and Victoria × (Hajira × Banner Sel. 524) proved resistant to all but one of these races. The last-mentioned strains and the oat varieties Victoria and Trispernia were also resistant to all races of crown rust used.

These results are taken to show that there is no lack of available rust-resistant breeding material in either wheat or oats in Canada.

KLEMM (M.). **Schadengebiete des Weizensteinbrandes (Tilletia tritici [Bjerk.] Winter) in Deutschland.** [Wheat bunt (*Tilletia tritici* [Bjerk.] Winter) zones of injury in Germany.]—*Forschungsdienst*, ix, 2, pp. 183–191, 1 graph, 9 maps, 1940.

A study of data supplied by the German plant protection stations and seed health reporters of the Statistical Office for the period from 1927 to 1938, inclusive, shows that, contrary to the general opinion, the incidence of wheat bunt (*Tilletia tritici*) [*T. caries*] among the winter varieties chiefly affected reaches a maximum in the regions adjoining the principal zones of cultivation of the crop and not in the latter themselves, with the exception of Württemberg. Generally speaking, the disease is most prevalent in localities where wheat is of relatively slight economic importance and the systematic seed-grain disinfection necessary to combat the fungus is either neglected or (as in Württemberg) difficult to practise on financial grounds, the bulk of the farms being of only moderate extent (5 to 20 ha.).

During the period under review 'bunt years' (i.e., those in which a tenth of the administrative zones of a given province reported heavy infection) recurred three times in north and central Germany (1933, 1934, and 1936) and four in the south (1927, 1930, 1936, and 1937), only one year, therefore, being common to both regions. Low soil temperatures at the period of germination of the seed [*R.A.M.*, xviii, p. 13 *et passim*], favour infection, a correlation frequently observed in the heavy soils and raw climates, e.g., of the Eifel Mountains and Württemberg.

Postponement of the sowing date as a means of preventing infection by *T. caries* can only be considered in the case of winter wheat, and then alone in districts where the frit fly [*Oscinis frit*] does not threaten such crops. The late sowing of summer varieties involves too heavy a yield reduction to be practicable.

VAN DER WALLE (R.). **Les affections charbonneuses des céréales.** [Cereal smut diseases.]—*Chron. bot.*, vi, 2, pp. 33–34, 1940.

This is a concise survey of some important contributions (mostly recent work noticed at the time of publication in this *Review*) to the understanding of various aspects of the parasitism of the loose smuts of wheat and barley (*Ustilago nuda tritici* [*U. tritici*] and *U. nuda*), respectively.

MURPHY (H. C.), BURNETT (L. C.), KINGSOLVER (C. H.), STANTON (T. R.), & COFFMAN (F. A.). **Relation of crown-rust infection to yield, test weight, and lodging of Oats.**—*Phytopathology*, xxx, 10, pp. 808–819, 1 graph, 1940.

The coefficient of crown-rust (*Puccinia coronata*) infection (percentage of infection × type) showed a higher negative correlation with the yield and test weight of the 442 varieties and selections of oats studied in connexion with the 1938 epidemic at Ames and Kanawha, Iowa, than did either percentage or type of infection alone. The total correlations between coefficient of crown rust and yield were all highly significant, ranging from —0·75 to —0·80. For each unit increase in coefficient of crown-rust infection (in the presence of the effect of test weight, ripening date, height, and lodging), yield was decreased by an average of 0·21 to 0·32 bush. per acre, the corresponding figure for the crown-rust coefficient alone being 0·40 to 0·47 bush. per acre. Yield and test weight (lb. per bush.) were closely correlated in all the trials, each lb. increase in weight connoting an average yield increase of 0·47 to 2·39 bush. per acre. Lodging, height, and maturity date were all negatively correlated with yield, i.e., the stiffer-strawed, shorter, and earlier varieties tended to be more productive than the weaker-strawed, taller, and later ones.

Breeding for resistance to crown rust [*R.A.M.*, xviii, p. 242 *et passim*] is of the utmost importance under conditions such as those encountered in Iowa, where epidemics similar to that of 1938 were also reported in 1927 and 1935, and such varieties as Boone, Marion, and other new selections resistant to this disease, stem rust [*P. graminis*], and loose and covered smuts [*Ustilago avenae* and *U. kolleri*] are urgently required and should prove highly valuable.

PIPER (C. S.). **Molybdenum as an essential element for plant growth.**—*J. Aust. Inst. agric. Sci.*, vi, 3, pp. 162–164, 1940.

The essential nature of molybdenum as a constituent in the growth requirements of oats was confirmed in 1939 in water culture experiments on the Algerian variety at the Waite Agricultural Research Institute, Adelaide [*R.A.M.*, xix, p. 727], traces of the element (0·02 or 0·1 mg. per l.) preventing the pale reddish-brown discoloration of the leaves affecting the controls, and increasing the grain and total yields.

KOEHLER (B.) & DUNGAN (G. H.). **Disease infection and field performance of bin- and hanger-dried seed Maize.**—*J. Amer. Soc. Agron.*, xxxii, 10, pp. 768–781, 3 figs., 1940.

One of the large-scale changes in the preparation of seed maize that took place when the production of hybrid seed developed as a specialized business was the use of hot-air drying bins instead of ear-hangers for drying the seed. This innovation has resulted in a considerable economy of space and labour, and investigations were conducted at the Illinois Agricultural Experiment Station to determine whether a corresponding improvement has occurred in the quality of the seed.

Bin-dried hybrid seed of the Commercial Hybrids A, B, C, and D, Illinois Hybrids 172, 384, and 582, and Griffith and Murdock Yellow

Dent varieties showed no superiority over material hanger-dried under appropriate conditions, as judged by field tests with fungicidally treated seed. In field trials with samples of maize from 22 seed-production fields dried in the two ways, the hanger-dried material averaged 3·2 bush. more per acre over a three-year period than that dried in bins, a statistically significant difference.

Ears of three commercial hybrids (Illinois 960, Nebraska 110, and U.S. 13) were hand-picked in seed-producing fields when the grain moisture was about 30 per cent., and divided at random into three lots of 120 each to determine the effect of different drying rates on internal seed infection and field performance. The ears were dried down to a 12 per cent. moisture content in controlled temperature and humidity tanks at three rates, viz., rapid (106° F., 32 per cent. relative humidity, requiring four days), moderate (70°, 65 per cent. relative humidity, one month), and slow (70°, 86 per cent. relative humidity, necessitating three months for reduction to 17 per cent. moisture). There was no appreciable difference in yield between the fast- and moderately fast-dried seed, but that dried slowly gave reduced stands and yields (2·9 to 11·6 bush. per acre less than the fast). This difference is attributed largely to infection by *Fusarium moniliforme* [*Gibberella fujikuroi*], *Penicillium* spp., *Nigrospora sphaerica* and *N. oryzae*, and *G. zeae* [*R.A.M.*, xvii, p. 519], the incidence of which in the rapid, moderate, and slow lots in 1937 and 1938 averaged 0·6, 5·1, and 33·1; 0·1, 0·2, and 15·6; 1·2, 4·6, and 8·3; and 0·0, 1·5, and 4·6 per cent., respectively. Decay was also caused by *Diplodia zeae*, *Cephalosporium acremonium*, and miscellaneous fungi. The total kernel infections of surface-sterilized seed (two-year averages) were 5·1, 18·3, and 69 per cent. for the rapid, moderate, and slow drying rates, respectively.

Field plots grown from nearly disease-free and *G. fujikuroi*-infected maize kernels from untreated ears dried in an identical manner showed some statistically significant reductions in yield from seed infection, averaging 1·8 bush. per acre over a three-year period.

THOMPSON (H. L.). **New treatment for chlorosis appears to be effective.** —*Citrus Leaves*, xix, 12, 13, 1939. [Abs. in *Chem. Abstr.*, xxxiv, 21, p. 7517, 1940.]

Lime-induced chlorosis of citrus [cf. *R.A.M.*, xvi, p. 313] has been corrected by drilling four holes in the soil surrounding the affected trees and filling each with about 3 lb. sulphur, which appears to produce local areas of acidity round the roots and thus neutralize the excess alkalinity. The latter is believed to render certain minor elements unavailable.

GUTMAN (G.). **The control of wastage by nitrogen trichloride (NCl_3).**—*Hadar*, xii, 4, pp. 111–112, 1939.

An account is given of the nitrogen trichloride process of citrus disinfection [*R.A.M.*, xvii, p. 444] against wastage in transit, mainly due to the green and blue moulds [*Penicillium digitatum* and *P. italicum*: ibid., xx, p. 13] and *Alternaria* [*citri*: ibid., xix, p. 699], which is stated to be now employed by the majority of Californian shippers. In experiments on a commercial scale in Tulare county in 1933–4 on Navel

oranges, untreated fruit showed 16·44 per cent. wastage after a month in storage, whereas in that exposed to nitrogen trichloride the wastage was only 3·41 per cent. In another test on fruit shipped to New York (an 11-day journey), the temperature in transit being 18·3° C. and the relative humidity 65 per cent., the amounts of wastage in the gas-treated and control lots were 1·2 and 8·5 per cent., respectively. Tests in 14 groves showed that fruit exposed to a concentration of 15 gm. gas per cu. ft. of air developed 1·06 per cent. wastage compared with 4·16 per cent. for the untreated controls.

Nitrogen trichloride, being 4·18 times heavier than air, is apt to affect breathing and sight, and is therefore passed through rubber hosing, while a tendency to explode above certain concentrations necessitates its admixture with air at a proportion of from 5 to 15 mg. per cu. ft. Fruits intended for long storage, for instance, lemons, are given three treatments, (1) when brought into the packing house in field boxes, (2) before packing, and (3) after loading into vans for transport to market. Most fruit is treated twice—before packing (three hours in special rooms with walls constructed of thin planks) and after loading, while in some cases only the last application is made. The gas penetrates the wrapping paper, so that this final treatment is designed to complete the sterilization process. The gas treatment in the vans, each of which usually contains 462 packed cases of fruit, lasts from five to eight hours, circulation being promoted by electric fans in the corners. In a special test by the California Fruit Growers' Exchange on fruit intentionally scratched with the nails in packing, the amount of wastage in the treated lots did not exceed 3 per cent. on arrival in New York, but the gas had been used at too high a concentration, causing the formation of brown rims round the bruises.

Van der Plank (J. E.), Van Wyk (G. F.), & Van Niekerk (O. T.). **Removal of sooty blotch from Citrus fruits.**—Reprinted from *Fmg S. Afr.*, xv, 170, pp. 201–202, 1940.

In this paper the authors describe a method of removing sooty blotch [*Gloeodes pomigena*] from citrus fruits by the use of a mixture of chloride of lime and sodium bicarbonate in the proportion of at least 10 to 12 oz. of the latter to 1 lb. of the former (Redheart Tropical brand) [see above, p. 52]. They point out that strong solutions are unstable, and bleaching plants adapted to the use of low concentrations are most economical in material. Strong mixtures for increasing the strength of solutions weakened through use may be made with the addition of soda ash, but ordinarily this substance is not desirable. The paper concludes with suggestions for avoiding waste and effecting economies in the chemicals used.

Rhoads (A. S.). **The cause and control of melanose.**—*Citrus Ind.*, xxi, 6, pp. 5, 9, 12, 5 figs., 1940.

A two- or three-day spell of cloudy, rainy weather is stated to provide optimum conditions for the infection of citrus fruits (among which grapefruit appears to be more susceptible than oranges) by *Diaporthe citri* in Florida, where control may be effected by the application, two to three weeks after the flowers have fallen, i.e., between 15th April

and 5th May, of 3–3–100 Bordeaux mixture plus 5 to 10 lb. wettable sulphur per 100 gals. In seasons when blooming is unduly prolonged or the spring is exceptionally wet, a subsequent treatment four weeks later may be advisable. Basic copper sulphate, copper ammonium silicate, and cuprous oxide are practically equal to Bordeaux in efficacy, and are moreover free from the undesirable tendency of the latter to increase the scale insect population of the sprayed surfaces, sometimes necessitating a supplementary spray, between 15th May and 15th July, of oil emulsion (1¼ to 1⅔ per cent. oil) or, in cases of milder infestation, 1 to 1½ gals. lime-sulphur plus 5 to 10 lb. wettable sulphur per 100 gals. Two important secondary benefits accruing from the observance of the melanose control schedule are a reduction of up to 50 per cent. in the incidence of stem-end rot, and a mitigation in the severity of exanthema associated with copper deficiency [*R.A.M.*, xiv, p. 628].

Bondar (G.). **Insetos nocivos e molestias do Coqueiro (Cocos nucifera) no Brasil.** [Noxious insects and diseases of the Coco-nut (*Cocos nucifera*) in Brazil.]—*Bol. Inst. centr. Fom. econ. Bahia* 8, 160 pp., 39 figs., 1940.

In part II of this manual on coco-nut pests and diseases in Brazil, the author gives notes (largely gleaned from foreign publications in the absence of relevant observations in the country itself) on *Fomes lamaoensis*, *Rhizoctonia bataticola* [*Macrophomina phaseoli*], *Thielaviopsis* [*Ceratostomella*] *paradoxa*, *Marasmius palmivorus*, *Phytophthora palmivora* (the effects of which on coco-nut are not usually serious under local conditions, though cacao pods are heavily damaged in the rainy season), *Pestalozzia palmarum*, and *Exosporium durum*, the two last-named being widespread in native plantings of *Cocos coronata* and *C. schizophylla*. *E. durum* may be the cause of appreciable damage, the diffuse spots on the leaves expanding into black crusts bearing the fructifications of the fungus, which sometimes attacks the opening leaflets, with resultant malformation of the midrib. When the peduncle and leaf rachis are invaded, prominent, elongated, pustular lesions develop and frequently exude an abundance of gum; the leaves become entirely blackened and cease to fulfil their vital functions in the metabolism of the plant, so that its health and productivity suffer.

Hendrickx (F. L.). **Observations sur la maladie verruqueuse des fruits de Caféier.** [Observations on the warty disease of Coffee 'cherries'.] —*Publ. Inst. nat. Étude agron. Congo belge*, Sér. sci., 19, 12 pp., 1 fig., 1939. [Received November, 1940.]

The author's studies on the symptomatology and morphology of the strain of *Botrytis cinerea* responsible for the warty disease of coffee 'cherries' [*R.A.M.*, xv, p. 704], observed for the first time in the Belgian Congo (Ngweshe district) in May, 1938, are described. The infected cherries turn brown prematurely, shrink, and become mummified, while the surface is covered with minute, greyish-white pustules, bearing conidiophores. The fungus appears to be incapable of extending its growth beyond the pedicel, and the shrivelled cherries remain attached to the bushes. The berry is generally either absent or

converted into an amorphous, black mass; if formed at all, as in certain cases of early infection, it is spotted and furnishes only a low-grade product. Thus, the damage from this source, though limited, is by no means negligible, especially as the shrivelled cherries afford shelter to the numerous insects infesting dried coffee and permit them to complete their life-cycles.

The fungus was isolated in pure culture and inoculated into wounded and unwounded cherries at different stages of growth with positive results, reisolation being effected in all cases. Infection was shown by these experiments to take place while the cherry is in process of development but has not yet attained full maturity. The pathogen differs from other *B.* spp. primarily in its longer and wider conidia, measuring 12·7 to 18·2 by 8·2 to 10·9, average 15·1 by 9·7 μ on naturally infected fruits, 8·2 to 14·3 by 6·1 to 8·2 (12·2 by 7·7) μ in culture, and 10·9 to 14·5 by 7·3 to 9·1 (12·7 by 7·9) μ on artificially infected fruits; these dimensions approximate fairly closely to those of *B. paeoniae* [ibid., vi, p. 668], the characteristic apical swellings of the conidiophores of which are, however, absent from those of the coffee pathogen. The conidia of the latter, moreover, are distinctly longer and wider than those of *B. cinerea* f. *lini* (11 by 7 μ) [ibid., xii, p. 372], narrower than those of *B. narcissicola* (13·2 by 9·5 μ) [ibid., vi, p. 510; xvii, p. 42], and smaller than those of a number of other allied species. The coffee strain is accordingly designated *B. cinerea* f. *coffeae* n.f. [with a Latin diagnosis], close to *B. cinerea* f. *lini*.

LEHMAN (S. G.). **Cotton seed dusting in relation to control of seedling infection by Rhizoctonia in the soil.**—*Phytopathology*, xxx, 10, pp. 847–853, 1940.

Cotton seed dusted with new improved ceresan (1½ or 3 oz. per bush.) was planted in steamed sandy loam plus river sand inoculated with *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xix, p. 147; xx, p. 14] in a greenhouse (maximum day temperature in the first two tests in March 80° to 85° F., and in the last two in June and August 95° to 100°) [? in North Carolina], an untreated lot serving as a control, while another series of dusted and non-dusted seed was run in uninoculated soil.

The dusted seed showed significantly greater improvement in seedling emergence on inoculated than on uninoculated soil when the seeds were planted soon after adding the fungus to the soil, the calculated F value for interaction between seed treatment and soil inoculation in two experiments being 47·9 and 96·8, which far exceeds the 8·02 required for high significance. Only insignificant differences in seedling emergence from dusted and non-dusted seed were observed, however, when several weeks were allowed to elapse between inoculation and planting. The numbers of seedlings (*a*) living after emergence and (*b*) escaping stem infections were increased by seed treatment in all the trials, but the increase was not relatively greater by a statistically significant amount on inoculated than on uninoculated soil.

It is concluded from these results that the application of organic mercury dust to cotton seed before planting exerts little or no protective action against *C. solani* in the soil, in contrast to its unquestionable efficacy against seed-borne organisms.

Miller (J. H.). **The genus Myriangium in North America.**—*Mycologia*, xxxii, 5, pp. 587–600, 1940.

Plectomycetous fungi comprising the genus *Myriangium* [*R.A.M.*, xvii, p. 627], found on the bark of woody plants covering dead scale insects, occur over the whole world, but are particularly common in the southern parts of the United States. In this paper the author gives a succinct historical résumé of the literature of the subject, together with a systematic account of the genus, and describes (with a key) the species found in North America, viz., *M. duriaei* [loc. cit.], *M. asterinosporum* (Ellis & Ev.) comb. nov., *M. tuberculans*, and *M. floridanum*.

Howell (A.). **Studies on Histoplasma capsulatum and similar form-species. II. Effect of temperature.**—*Mycologia*, xxxii, 5, pp. 671–680, 3 figs., 1 graph, 1940.

Continuing his earlier investigations [*R.A.M.*, xviii, p. 456], the author found that the optimum growth temperatures for *Histoplasma capsulatum* [ibid., xix, p. 706], *Sepedonium chrysospermum*, *S. xylogenum*, and *Stephanoma tetracoccum* were, respectively, 25°, 20°, 25°, and 20° C. When *Sepedonium chrysospermum* was grown on potato maltose agar, sporulation was greatest at 25°, and not at temperatures at which radial growth reached a maximum. With *Stephanoma tetracoccum*, *H. capsulatum*, and *Sepedonium xylogenum* sporulation was directly correlated from the first with abundance of mycelium. Attempts to restore the tolerance of *H. capsulatum* to body temperature (37·5°) were only partly successful.

Vadalà (A. J.). **Mycotic infection of the broncho-pulmonary tract.**—*Ann. Otol., etc., St. Louis*, xlix, 2, pp. 291–358, 34 figs., 1940.

From an intensive study of the relevant literature, combined with personal observations at Ancon, Panama Canal Zone, the writer concludes that mycotic disease of the respiratory tract can be definitely diagnosed by bronchoscopic examination and study [*R.A.M.*, xx, p. 15], though diagnosis is stated to be immensely assisted by proper X-ray interpretation, supplemented by differential cultural studies.

The second part of the paper consists of detailed reports of 11 cases of broncho-pulmonary mycosis, in several of which *Torula histolytica* [*Debaryomyces neoformans*: ibid., xix, pp. 150, 536] and in one a member of the *Aspergillus fumigatus* group were implicated.

Swartz (J. H.) & Conant (N. F.). **Extensive lichenified eruption caused by Trichophyton rubrum.**—*Arch. Derm. Syph., Chicago*, xlii, 4, pp. 614–624, 6 figs., 1940.

Four cases of severe dermatophytosis causing an extensive lichenified eruption are reported, two (both on women at the Massachusetts General Hospital) being described in detail. Cultural and morphological studies of the pathogen on Sabouraud's dextrose agar established its identity with *Trichophyton rubrum*, characteristic features of which included an abundance of unicellular, subspherical microconidia, produced laterally along the slender hyphae and in clusters on the side branches, and elongated, clavate, multicellular, thin-walled macroconidia borne at the expanded ends of the hyphae. A list is given of

27 other species producing a red to purplish pigmentation in culture, the relegation of which to synonymy with *T. rubrum* [ibid., xiii, p. 303; xviii, p. 678] is proposed.

Moore (M.) & Conrad (A. H.). **Microsporosis of the scalp caused by Microsporum fulvum: report of a case and description of the fungus.**—*Arch. Derm. Syph., Chicago*, xlii, 4, pp. 610–612, 3 figs., 1940.

On Sabouraud's dextrose agar, *Microsporon fulvum* [*R.A.M.*, xix, p. 279], isolated from a circular patch of dermatitis on the scalp of a four-year-old boy at St. Louis, Missouri, forms in 16 days a white central umbo, surrounded by a powdery, ochraceous- or pinkish-buff to pale cinnamon-coloured, velvety down, which may in turn be encircled by an irregular, white, cottony growth (incipient pleomorphism). Concentric zones develop on maltose agar. The colonies consist of a large number of four- to six-celled, ellipsoid, thin-walled, verrucose fuseaux (macroconidia or closterospores), 30 to 55 by 10 to 15 μ, produced in groups of 12 to 15 on branched conidiophores, and of spherical or ovoid microconidia or aleuriospores, 3 to 5 by 2 to 4 μ, sessile or borne on short sterigmata. On sugar media chlamydospores, arthrospores, nodular bodies, pectinate hyphae, and spirals also develop.

The interest of this case centres largely in the rarity of the parasite in the United States, especially in the Mid-West.

McKay (R.). **Heat canker of Flax.**—*J. Dep. Agric. Éire*, xxxvii, 2, pp. 383–386, 2 figs., 1940.

In June, 1939, samples of flax suffering from a disease apparently identical with heat canker [*R.A.M.*, vi, p. 402; viii, p. 371; xix, p. 707], not previously reported from Ireland, were received from three separate farms on peaty soil in Co. Donegal. The most characteristic feature of the affected plants was the more or less sharply defined constriction of the stems at soil-level, just above which there was a tendency to swelling of the stem and the production of adventitious buds. The plants were 3 to 5 in. in height and the roots were thin and thread-like as a result of starvation, due to the inhibition of the downward flow of manufactured food materials from the top of the plant through the dead, shrunken cells of the cortex at the site of constriction, where *Corticium solani* was present as a secondary invader in a minority of cases (less than 10 per cent.), darkening the tissues and imparting a resemblance to damping-off.

Constriction of the stems at soil-level is mentioned by Pethybridge *et al.* (*J. Dep. Agric. Ire.*, xx, p. 327, 1920) as one of the phases of seedling blight (*Colletotrichum lini*), but in cases of fungal infection the dark stem lesions with water-soaked margins are usually accompanied by discoloration of the foliage and bear the minute, black setae of the pathogen, and the stem is of about the same diameter above as below the point of constriction. Spores of the fungus develop profusely after a few hours' incubation of the diseased stems in a moist chamber. It is evident, therefore, that heat canker is entirely unconnected with seedling blight.

The exceptionally hot weather prevailing towards the end of May

and in early June, 1939, is thought to have favoured the outbreak of heat canker, for which a high soil temperature—54° C. according to Reddy and Brentzel [*R.A.M.*, ii, p. 314]—is required.

Longrée (Karla). **Chalaropsis thielavioides, cause of 'black mold' of Rose grafts.**—*Phytopathology*, xxx, 10, pp. 793–807, 5 figs., 4 graphs, 1940.

Rose-growers in the eastern States of the American Union and near Chicago were confronted in 1938–9, and probably earlier, by an unfamiliar disease of home-grown *Rosa manetti* grafts released from a small area in northern Oregon. The cut surfaces were covered with the hyaline, later greenish, septate mycelium, similarly coloured endoconidia, and fuscous macroconidia of *Chalaropsis thielavioides*, the last-named organs imparting the typical aspect of 'black mould' [*R.A.M.*, xix, p. 409]. The pathogen may invade the cortex, the lumen of the vessels, the medullary rays, and the small parenchyma cells of the pith, both stocks and scions being affected. Infection prevents the formation of callus and the 'taking' of grafts, thereby causing the death of the scions involved. The fungus was also isolated from Chinese elm [*Ulmus campestris* var. *chinensis*] roots.

Inoculation experiments were carried out by various methods. In one series, the cut surfaces of *R. manetti*, *R. multiflora*, and Ragged Robin stocks, and of Queen Mary and White Killarney scions were dipped before grafting in a conidial suspension of a culture of the fungus from *R. manetti*; in another, a suspension was introduced into cut stems, and in a third, into cut ends, positive results being obtained in all cases, whereas no infection developed on unwounded stems sprayed with inoculum and kept moist for three weeks.

The general morphological characters of the rose pathogen conform to Peyronel's description (*Staz. sper. agr. ital.*, xlix, pp. 583–596, 1914), the width of the mycelium ranging from 2·2 to 5·4 μ, the average length of the hyaline to olive-green endoconidia from rose stems ranging from 11·2 to 14·9 and their width from 3·7 to 5·6 μ, the same from elm roots 14·1 to 15·3 and 3·4 to 4·3 μ, respectively, the hyaline to olive-green or fuscous macroconidia from rose 13·4 to 13·5 and 11·3 to 11·5 μ, respectively, and the same from elm 13·9 to 14·9 and 12·2 to 13·5 μ, respectively [ibid., xiv, p. 801]. The maximum germinability of the endoconidia (95 per cent. at 18° to 21° C.) occurred in two-day-old cultures, whereas the macroconidia took from three to five months to reach a corresponding stage of maturity, the maximum germination of about 25 per cent. taking place at 12°. Both endo- and macroconidia frequently germinated directly into endoconidiophores from which fresh crops of endoconidia were produced. The minimum, optimum, and maximum temperatures for the growth of *C. thielavioides* from rose on potato dextrose agar were found to lie between 0° and 3·5°, 18° and 27·5°, and 30·5° and 33°, respectively. The temperature relations of the elm strain of the fungus were very similar, but the growth rate in this case was much more rapid. The rose isolate was able to grow (only superficially) and fruit on unsterilized pieces of Chinese elm, walnut, poplar, and peach wood, as well as on raw potato tuber and carrot, while the elm strain made a certain amount of growth on rose

stems. The rose strain (and to a lesser degree the elm isolate) exuded a characteristic sweet, fruity odour resembling that of isobutyl acetate when growing freely in culture or fruiting on rose tissue in moist chambers.

Cooper (K. W.). **Relations of Pediculopsis graminum and Fusarium poae to central bud rot of Carnations.**—*Phytopathology*, xxx, 10, pp. 853–859, 1940.

The name 'central bud rot' is proposed for the disease of carnations caused by *Fusarium poae* [*R.A.M.*, xix, p. 153] in place of the no longer applicable '*Sporotrichum* bud rot'. Young infected buds may appear outwardly normal, but on opening reveal a moist, brownish decay of the inner floral organs. The pistils, stamens, styles, and petal bases are sometimes completely rotted by the fungus. Embedded in the mass of disintegrated tissue and white, cottony fungal growth are the glistening, white, ellipsoid bodies of pregnant mites of *Pediculopsis graminum*, up to 3 mm. in length. Severely infected young buds usually fail to open, but medium-sized and large ones may do so, the open flower in such cases presenting a peculiar lop-sided appearance due to unilateral unfolding. The internal symptoms of the larger buds are similar to those observed in young tissues, accompanied by an external basal softening. White varieties are the most susceptible to central bud rot, which has been recorded from Nebraska, New York, Illinois, and New Jersey, as well as from Germany and New South Wales.

Positive results were given by the inoculation with cultures of *F. poae* from common grasses at Princeton, New Jersey, of slightly lacerated buds of an unnamed yellow, pink-flecked variety. Of these, 40 out of 50 became infected and all but one showed visible symptoms of the rot after an incubation period of a week and upwards at 12° to 16° C. The size of the buds at the time of inoculation exerted little effect on the course of the disease, which also caused no retardation of calyx growth, except in the smallest of those used in the experiments, for a period of at least 16 days. Buds exceeding 20 by 10·5 mm. nearly always tended to open by the close of the trials, notwithstanding extensive central decay. The dissection of two diseased buds of a pink variety on an adjacent bench revealed the presence of *F. poae*, which apparently could only have been transmitted by thrips present in the buds; in this connexion Wollenweber and Reinking's observation of the association between *Anaphothrips* and the fungus is of interest [ibid., xv, p. 321]. More than half of a number of strains of *F. poae* weakened by three years in culture without re-passage through normal hosts regained their former vigour and capacity for staining the medium an intense violet-red after a brief occupation of carnation buds, but the recovery was only temporary. Of 119 buds on plants of four different-coloured carnations exposed to soil infestation by hundreds of actively wandering *P. graminum* released from infected tube cultures of *F. poae* growing on potato dextrose agar, 24 (20 per cent.) developed bud rot, the highest incidence (12 out of 28) occurring in a pink-flecked white variety. It is considered evident from these data that the mite acts as a vector of the pathogen, the gnawing of the tender tissues by the nymphs apparently inflicting the wounds necessary for its ingress.

The pregnant mites are believed to obtain their nourishment exclusively from diseased buds.

The conclusion of Molz and Morgenthaler (*Ber. dtsch. bot. Ges.*, xxx, pp. 654–662, 1912) that central bud rot was introduced into Germany on North American carnations would seem to be invalidated by the observations of Korff (*Prakt. Bl. Pflanzenb.*, iii, pp. 109–113, 122–126, 1905) and others on the prevalence of *P. graminum* in connexion with 'white ears' of Gramineae in German meadows and grain fields.

CELINO (M. S.). **Experimental transmission of the mosaic of Abacá, or Manila Hemp plant (Musa textilis Née).**—*Philipp. Agric.*, xxix, 5, pp. 379–403, 5 pl., 1940.

Abacá (*Musa textilis*) mosaic (*Cucumis* virus 1 or *Marmor cucumeris*), which is assuming an increasingly destructive character in Davao, Philippines [*R.A.M.*, xviii, p. 801], was experimentally shown to be readily communicable from diseased to healthy plants by *Rhopalosiphum nympheae* and *Aphis gossypii*, which were unable, however, to transmit bunchy top of the same host [ibid., xviii, p. 444], probably owing to the specific relationship prevailing between the latter virus and *Pentalonia nigronervosa*. The mosaic virus, which is regarded as identical with that of Magee's infectious chlorosis of banana [ibid., xix, p. 481], proved to be non-transferable to healthy plants by *R. nigronervosa*, *Ferrisia* [*Ferrisiana*] *virgata*, and *Stephanitis typicus*, by needle pricks, or by sap injection.

The first perceptible symptom of mosaic, appearing eight to ten days after the feeding of viruliferous aphids on healthy plants, consists of small, yellowish-white dots on the newly unfurled leaves, elongating into short, narrow dashes but retaining their original central dots; the later developing foliage shows typical mottling, which also occurs in an advanced stage of infection on the petioles and pseudostems of succeeding leaves. Eight adults of *R. nympheae* suffice to inoculate an abacá seedling with an effective dose of the virus, which is not transmitted from adults to their progeny. The aphids require a period of two hours' feeding on diseased plants to obtain the virus, which is all lost again in the first feeding on a healthy abacá.

The abacá mosaic virus was experimentally transmitted to *Canna indica*, but not to *C. edulis* or other *C.* spp., cotton, or camia (*Hedychium coronarium*), while attempts to convey it to a number of banana varieties also failed, possibly because the aphids were unable to gain a foothold on the plants. *R. nympheae* and *A. gossypii* penetrate the young abacá foliage either through the stomata or directly by way of the lower epidermis, their stylets passing between and occasionally through the cells to reach the phloem.

The measures recommended for the exclusion and eradication of bunchy top from abacá plantations [ibid., xi, p. 46; xiii, p. 444] are likewise applicable to mosaic.

LASKARIS (T.). **Report of the Delphinium crown rot investigation fellowship.**—*Delphinium, 1939*, pp. 102–108, 5 figs., 1939. [Abs. in *Exp. Sta. Rec.*, lxxxiii, 3, p. 359, 1940.]

Studies in progress are reported to have shown that the fungus

responsible for a serious new crown and root rot of larkspur is a hitherto undescribed species of *Diplodina*, which is also capable of causing foliar blight, local stem necrosis, and canker. A brief survey is given of other organisms producing similar diseases of the same host [cf. ***R.A.M.***, xix, p. 475].

MACHACEK (J. E.). **The effect of the yellows disease on the germinating ability of Gladiolus corms.** *Gladiolus, 1940*, pp. 55, 57–58, 1940. [Abs. in *Exp. Sta. Rec.*, lxxxiii, 3, p. 359, 1940.]

Experiments reported to the New England Gladiolus Society appear to indicate that gladiolus corms affected by yellows are practically useless for planting, only 5 and 9 per cent. germinating, respectively, in two tests described, and disinfection with semesan being ineffectual.

MCKENZIE (M. A.), JONES (L. H.), & GILGUT (C. J.). **Study practical Gardenia canker control as disease increases.** — *Flor. Rev.*, lxxxv, 2209, pp. 11–13, 3 figs., 1940. [Abs. in *Exp. Sta. Rec.*, lxxxiii, 3, p. 359, 1940.]

Investigations in Massachusetts are reported to have shown that *Gardenia* losses due to infection by *Phomopsis gardeniae* [*R.A.M.*, xix, p. 413] have increased with the general replacement of varieties of the *veitchii* group by the larger-flowered but susceptible Belmont and Hadley. The symptoms of the disease and methods for its control (including the segregation of new plants at some distance from diseased ones) are discussed.

PLAKIDAS (A. G.). **Angular leaf spot of Pittosporum.**—*Mycologia*, xxxii, 5, pp. 601–608, 4 figs., 1940.

Both green and variegated varieties of *Pittosporum* shrubs in gardens in Florida, southern Louisiana, and along the Mississippi coast are affected by an angular, chlorotic spotting. Completely necrotic spots are rare, and the infected tissue remains alive for a very long time. At first pale green, and scarcely discernible unless examined by transmitted light, the spots (which measured 1 to 5 mm. across, but sometimes coalesce and cover more than one-half the leaf area) later turn yellowish-brown on the upper and olive-brown on the lower surface. In most cases, the condition is not serious, though individual shrubs may appear chlorotic, sickly, and unsightly. Severely affected shrubs may occur next to or between others which remain unaffected, although all the *Pittosporum* plants in the region under observation (the investigation was carried out at the Louisiana Agricultural Experiment Station) belong to the species *P. tobira* and are propagated vegetatively. The disease persists through the summer and winter, though infection appears to take place only in the warm season. Inoculations outdoors of attached shoots by (1) spraying the leaves with an aqueous suspension of the spores from naturally infected leaves, (2) brushing dry spores from naturally infected to healthy leaves, and (3) placing diseased in contact with healthy leaves gave strongly positive results in three to four weeks.

Infected material showed the presence of a fungus with internal and external, hyaline, regular to irregular hyphae, 2 to 4·4 μ in diameter,

conidiophores hyaline at first becoming slightly dusky with age, 22 to 65 by 3·9 to 5·8 μ, and hyaline, cylindrical to narrowly obclavate, straight or curved conidia, narrowing at the base with the point of attachment rounded or narrowly truncate, with 3 to 13 septa occasionally constricted at the septa, and measuring 34 to 143 by 3 to 4·4 μ. The organism is named *Cercospora pittospori* n.sp. [with a Latin diagnosis].

Brown (A. M.). **An aberrant strain of Puccinia helianthi Schw.**—*Canad. J. Res.*, Sect. C, xviii, 10, pp. 513–517, 1 pl., 1940.

An aberrant strain of *Puccinia helianthi* [*R.A.M.*, xvi, p. 184] was observed in haploid infections arising from germinating teleutospores on a single leaf of *Helianthus tuberosus*. Teleutospores from several other leaves of the same collection were induced to germinate, but produced only normal infections. The uredospores of the aberrant strain were paler, smoother, smaller, and more finely echinulate than those of the parent. The aberrant rust further differed from the parent strain in pathogenicity, attacking *H. tuberosus* only weakly and *H. subtuberosus* and *H. subrhomboideus* not at all, whereas the normal strain attacked all three vigorously. It was less tolerant of warm temperatures and practically inter-sterile with the parent strain. It is suggested that these differences are due to mutation involving the loss or gain of chromatin carrying more than one gene.

Holz (W.). **Fortschritte in der Bekämpfung von Fusicladium dendriticum (Wallr.) Fckl mit chemischen Mitteln in den Jahren 1936–1938.** [Progress in the control of *Fusicladium dendriticum* (Wallr.) Fckl by chemical means in the years 1936 to 1938.]—*Forschungsdienst*, ix, 9, pp. 278–288, 1940. [Abs. in *Hort. Abstr.*, x, 3, p. 243, 1940.]

Reviewing investigations on apple scab (*Fusicladium dendriticum*) [*Venturia inaequalis*] control in Germany from 1936 to 1938 [*R.A.M.*, xviii, p. 531], the author summarizes the present position of the problem as follows. Pre- and post-blossom spraying with standard fungicides gives the best results; the operations should be initiated before the main ascospore flight begins, in which connexion two methods of predicting the date of this event have been devised by the writer and are expected shortly to be published. The main objections to early spring Bordeaux treatment in Germany are injury to the trees, inadequate control, and shortage of copper. Spraying at full bloom with copper-lime, lime-sulphur, and nosprasit, though successful at the outset, failed to combat the disease effectively, while a new proprietary preparation, pomarsol (Ob 72), containing sulphur but no arsenic and non-toxic to bees, also proved unsatisfactory [ibid., xix, p. 26]. Experiments are in progress to obtain safe and efficacious fungicides by the extraction of plant juices in the Solanaceae, Ranunculaceae, and Compositae families, and decoctions of *Solanum nigrum* and *S. dulcamara* have already given encouraging results in laboratory trials. So far, the only work done in Germany on the inhibition of the winter development of the fungus consists in laboratory applications of nitro-lime to freshly fallen and rotting leaves, in which all perithecia of the fungus were killed.

Smock (R. M.) & Van Doren (A.). **Studies with modified atmosphere storage of Apples.**—*Refrig. Engng*, xxxviii, 3, pp. 163–166, 2 figs., 1939.

A detailed, tabulated account is given of experiments at Cornell University, New York, in which McIntosh apples were maintained until June in excellent condition and free of brown core [*R.A.M.*, xvii, p. 399] in several modified atmospheres at 40° F. Probably the best atmosphere of those tested was 5 per cent. carbon dioxide and 2 per cent. oxygen, followed by 10 per cent. carbon dioxide and 2 per cent. oxygen, and by 5 per cent. of each constituent. Held in 10 per cent. carbon dioxide and 11 per cent. oxygen, an atmosphere that could be maintained by ventilation alone, the fruit kept well until June and remained marketable for ten days at room temperature after removal from storage. This atmosphere, however, permitted the development of a slight amount of brown core late in the storage season even at 40°, the defect being much more prevalent in most atmospheres at 36°. Cortland apples responded very similarly to McIntosh as regards firmness, but proved highly susceptible to scald; this variety is therefore not recommended for modified atmosphere trials pending the development of a better method of scald control than oiled paper wrappers. Preliminary experiments on Rhode Island Greenings and Yellow Newtowns denoted encouraging possibilities in this respect (and incidentally in the elimination of [unspecified] moulds) through the use of ozone [ibid., xix, p. 479] in modified atmosphere chambers, the storage atmosphere being first treated with relatively high concentrations (e.g., 5 parts per million), which are then reduced to a non-toxic strength (1 : 2) by passage through a deozonizer before returning to the chamber proper.

Wallace (T.). **Magnesium deficiency of fruit trees : the comparative base status of the leaves of Apple trees and of Gooseberry and Black Currant bushes receiving various manurial treatments under conditions of magnesium deficiency.**—*J. Pomol.*, xviii, 3, pp. 261–274, 1940.

Further studies [which are fully described] on the base status of the leaves of apple trees and gooseberry and black currant bushes growing on similar soils under conditions of magnesium deficiency and receiving various manurial treatments [*R.A.M.*, xix, p. 605] showed that the magnesium oxide status was similar in all three kinds of fruit, though in gooseberries and black currants the levels were raised when potash was deficient or dung was applied. The evidence obtained suggested that 0·40 per cent. magnesium oxide and 20 mg. equivalents magnesium oxide per 100 gm. of dry matter are approximate levels below which magnesium deficiency will occur with all three kinds of fruit.

Thornton (R. P.). **Peaches as a potential crop in south Florida.**—*Citrus Ind.*, xxi, 6, pp. 10–11, 17, 1940.

One of the foremost obstacles to the successful production of peaches on a commercial scale in south Florida, intermittent attempts at which have been made since 1894, lies in the extreme susceptibility of the trees to the *Clitocybe* root rot fungus [*C. tabescens*: *R.A.M.*, xviii,

p. 789], for which no remedy appears to have yet been devised. To date, in 3½-year-old plantings of the Jewel variety, 192 trees have been killed and 146 are seriously affected, most of which are not expected to survive beyond 1940, while a further 200 show mild symptoms of the disease.

Siegler (E. A.) & Bowman (J. J.). **Propagation of Sour Cherries by piece-root grafting to avoid spraying seedling stocks for leaf spot.**—*Phytopathology*, xxx, 10, pp. 873–876, 1940.

The well-known susceptibility of Mazzard cherry seedlings to leaf spot (*Coccomyces hiemalis*) largely precludes their use as a stock for the Early Richmond and Montmorency sour varieties, the numerous fungicidal treatments necessary for even partial control of the disease under average climatic conditions in the United States being too expensive to admit profitable cultivation. In experiments at the Beltsville (Maryland) Horticultural Station, however, satisfactory stands of the two sour cherries were secured by grafting them on to piece roots taken from the collar region ('top cut') of the Mazzards, Mahalebs proving less suitable for this purpose; 68 and 58 per cent., respectively, of Early Richmond and Montmorency 'took' by this method, as compared with 32 and 39 per cent., respectively, for pieces originating below the root. Stands of the former extent are regarded as quite sufficient from the nurseryman's standpoint.

Dicker (G. H. L.). **On Rubus aphides and leaf-hoppers as possible vectors of Raspberry mosaic.**—*J. Pomol.*, xviii, 3, pp. 275–286, 1 fig., 1940.

Attempts at East Malling to find an insect vector of raspberry mosaic [*R.A.M.*, xix, p. 293] having proved unsuccessful, the author made a survey of the fauna of cultivated forms of *Rubus*, and carried out transmission tests with likely vectors. Eight species of aphids and seven of leafhoppers were found, but the evidence obtained made it possible to eliminate all of these, except the ubiquitous *Amphorophora rubi* and *Aphis idaei*. Trials with these two insects failed to demonstrate transmission; the number of unhealthy plants in the inoculated units suggested that one or both may, perhaps, transmit mosaic, but if so, the symptoms do not appear until the following summer. The inconclusive results of these experiments may, possibly, be explained by the discovery that the Lloyd George raspberry is a symptomless carrier of the most serious form of mosaic [loc. cit.].

While mosaic is the most prevalent and important disease of *Rubus* spp., certain varieties are also affected by other diseases that appear to be of virus origin. Symptoms resembling dwarf [ibid., xvii, p. 473] have been observed in Great Britain on phenomenal berry [a distinct pomological variety of *R. loganobaccus*] and cut-leaved blackberry [*R. laciniatus*], as well as (to a less extent) on Himalaya [*R. procerus*] and Black Diamond blackberries, youngberry, and boysenberry. Two isolated cases have occurred on raspberries at East Malling, on MacLaren's Prolific in 1938, and a hybrid seedling in 1939. A mosaic has occasionally widely affected Bedford Giant raspberries.

HEUBERGER (J. W.). **A laboratory biological assay of tenacity of fungicides.**—*Phytopathology*, xxx, 10, pp. 840–847, 1 graph, 1940.

A tabulated account is given of the writer's investigations at the Connecticut Agricultural Experiment Station on the development of a simple, rapid, and effective laboratory washing test for use in the evaluation of fungicidal tenacity (defined as the ability of a fungicide to resist weathering) [*R.A.M.*, xvi, p. 695].

The so-called 'rapid test', simulating the washing and beating action of rain in nature, was carried out as follows. A standard moist chamber half (221 by 75 mm.) was filled with water, in which were immersed for $\frac{7}{8}$ of their length after $1\frac{1}{2}$ hours' drying, two sprayed slides, the sprayed surfaces facing outwards: these were drawn rapidly across from one side to the other, raised from the water, sharply jerked, re-immersed, drawn rapidly back across to the opposite side, and so forth for 20 strokes, a period of 20 seconds being required for the entire process. The fungicidal value of the unwashed and washed deposits was assayed by methods recently described [ibid., xix, p. 665].

In comparative tests the rapid method was found to be as effective as other tests in removing fungicidal deposits and its superior speed is an advantage.

The applicability of the rapid test to the determination of fungicidal tenacity was tested as follows. Each of a paired series of coated slides was sprayed with Bordeaux, red copper oxide, yellow copper oxide, basicop, compound A, copper hydro 40, coposil CDV, and Z–O, using a precision sprayer [ibid., xx, p. 27], in such a way as to give deposits of known quantity over the range of 0 to 100 per cent. spore inhibition with *Macrosporium* [*Stemphylium*] *sarciniforme*; after $1\frac{1}{2}$ hours' drying, one slide of each pair was given 20 strokes, the fungicidal value of the washed and unwashed deposits being then ascertained in the usual way. The tenacity of the various materials was evaluated as follows. The data on spore inhibition for both the washed and unwashed deposits were plotted on the same sheet of logarithmic probability paper [ibid., xviii, p. 753], using the ordinate for percentage spore inhibition and the abscissa for original deposits in micrograms per sq. cm. in both cases. A straight line was fitted to each set of data for the points between 10 and 90 per cent. spore inhibition. The situation of the line for washed deposits below that for the unwashed shows that some of the initial deposit was removed by washing. The L(ethal) D(ose) 50 point on each line was determined by inter- or extrapolation, and the LD 50 deposit for the unwashed slides divided by that for the washed ones, the quotient measuring the amount of the deposit adhering during washing. For instance, a quotient of 1·00 (unity) indicates that none of the deposit is removed by washing, whereas one of 0·40 signifies that 40 per cent. adhered. The quotient thus serves as a measure of relative tenacity and is termed the 'tenacity coefficient'. The following values were obtained (averages of two to three tests): Bordeaux 0·880, red copper oxide 0·855, yellow copper oxide 0·834, basicop 0·544, compound A 0·467, copper hydro 40 0·340, coposil CDV 0·333, and Z–O 0·316. The order of tenacity of Bordeaux, red copper oxide, and coposil CDV agrees with the data reported by Magie and Horsfall (abs. in *Phytopathology*, xxvi, pp. 100–101, 1936) for similar materials on apple and

cherry foliage in the field in 1934 and 1935, based on chemical analysis of deposits before and after rain. The writer's results, except as regards basicop, also agree in essentials with those of McCallan and Wilcoxon [*R.A.M.*, xvii, p. 540], based on chemical analysis of deposits before and after one minute of 'artificial rain'.

The copper compounds used in these tests did not contain appreciable quantities of spreader, the inclusion of which necessitates a correction in the data, since the drops of spore suspension do not cover the same area on washed and unwashed deposits owing to the removal by washing of much of the adhesive. The same number of spores are thus exposed to different amounts of deposit.

TURNER (C. N.). **Wear in sprayer nozzle disks.**—*Agric. Engng, St Joseph, Mich.*, xxi, 10, pp. 393–394, 405, 4 figs., 1940.

In a study of the failure of parts of potato-sprayers owned by 85 growers in Aroostook County, Maine, the writer found that nozzle disk defects represented 64 per cent. of the total number of failures, among the factors involved in which are the type and concentration of disinfectant used in the spray mixture; the amount of foreign material, such as sand, in the water supply; the pressure applied to the mixture at the nozzle aperture; the size of the disk orifice; variations in the construction of the nozzle, especially the whirl plate; and the composition and thickness of the nozzle disk.

Experiments showed that wettable sulphur (2 lb.), lead arsenate (1 lb.), and hydrated lime (2 lb.) in 25 gals. water caused little wear, except to the Hardie disk (Hardie Manufacturing Co., Hudson, Mich.), which underwent severe chemical corrosion in a test lasting 18 hours at a pressure of 380 lb. per sq. in. Single-strength Bordeaux mixture (2–2(hydrated lime)–25, 12 hours, same pressure) was responsible for most of the wear on disks Nos. 2, 3, and 4 (monel 'K' in the 'as-rolled' condition, 'Z' nickel 'as-rolled', and inconel, respectively), all cold-rolled, full hard temper, supplied by the International Nickel Co., New York, the deleterious effect of the same spray at double strength being still more marked. Using Republic 17–17 steel as a check in two tests (double-strength Bordeaux, 380 and 460 lb. per sq. in.), disk No. 7 of U.S.S. '12' steel (Carnegie-Illinois Steel Corp., Cincinnati, Ohio) proved to be the most resistant to wear of any of the ten metals tested, followed by inconel, heat-treated 'Z' nickel, and Allegheny '12' steel (Allegheny Ludlum Steel Corp., Brackenridge, Pa).

A $\frac{4}{64}$ in. drilled hole in material 0·032 in. thick does not form a true orifice but makes a cylindrical hole, the sharp inside edges of which showed the only signs of wear on the entire disk; these were rounded off in less than one hour's run in the test with double-strength Bordeaux at 460 lb. per sq. in. Such wear not only increased the rate of discharge but also changed the character of the spray zone. Increase in diameter of the orifice reported by other workers was not observed in these trials.

Proceedings. Discussion on plant diseases and the weather.—*Trans. Brit. mycol. Soc.*, xxiv, 2, pp. 264–266, 1940.

The following aspects of the connexion between climatic conditions

and plant diseases were discussed at a meeting of the British Mycological Society on 19th February, 1940.

W. C. Moore cited a number of examples from the Ministry of Agriculture's monthly summary of plant disease records showing the influence of seasonal factors on various fungi. For instance, a wet May is thought to portend severe outbreaks of apple scab [*Venturia inaequalis*], chocolate spot of [broad] beans [*Botrytis cinerea*: ibid., xvi, p. 724] may be expected to follow a dull, showery period between April and July, and clover rot [*Sclerotinia trifoliorum*: ibid., xvii, p. 825] is favoured by a mild winter succeeding a wet autumn [ibid., xviii, p. 319]. The rapid diffusion of *Antirrhinum* [*majus*] rust [*Puccinia antirrhini*] in a destructive form in England was undoubtedly initiated by a series of hot summers commencing in 1933 [ibid., xiii, p. 445]. Virulent outbreaks of gooseberry cluster cup rust [*P. pringsheimiana*] followed a dry March in 1929, 1931, and 1933: it has been suggested by A. Smith that under these conditions, germination on the alternate sedge [*Carex*] host is temporarily delayed and then occurs in profusion at a time when the gooseberry foliage provides a wide surface area for spore colonization. A fairly severe attack in 1938 was forecast on the basis of these observations.

Dealing with the influence of weather on apple canker (*Nectria galligena*) [ibid., xix, p. 27], R. W. Marsh stated that ascospore discharge had been shown by means of vaselined slide spore traps to be very closely correlated with the volume of precipitation, but not with temperature, humidity, wind, or sunlight. The tolerance of low temperatures by the fungus, combined with its high rate of spore production from the autumn to the spring, contributes appreciably to its successful infection of the dormant tree through leaf scars, scab [*V. inaequalis*] lesions, woolly aphis [*Eriosoma lanigerum*] galls, or pruning cuts and wounds in the bark. Leaf scar infection can take place in the spring or autumn, but not in mid-winter, when it is quite possible, however, for the organism to enter through pruning cuts. Freshly inflicted wounds are the most susceptible, so that pruning should be carried out during cold, dry periods when the cut tissues can acquire resistance through ageing before spore discharge is resumed.

R. V. Harris described experiments in which dwarf-lateral scorch and die-back [ibid., xix, p. 690] developed in Lloyd George raspberries kept in a greenhouse with a mean temperature of 48° F. during December and January, but not in those placed in a cold storage chamber at 31·5°, both series being subsequently transferred to a cool orchard house until the following winter. Among the affected plants, 81 per cent. of the fruit canes died, and the leaf, crown, and root symptoms resembled those occurring in the field, vegetative growth of the stool being stimulated. The Baumforth's Seedling B variety underwent no change at the mild winter temperature, but in further tests die-back occurred on loganberry, phenomenal berry [a pomological variety of *Rubus loganobaccus*], and Himalaya berry [*R. procerus*] cool-stored at 40°.

Observations since 1935 by Mary E. King and R. V. Harris on soil temperature and rainfall in relation to yellow edge of Royal Sovereign strawberry [ibid., xix, p. 716] revealed a connexion between

intensity of infection and weather conditions in the preceding week or fortnight. Temperatures do not usually rise to a height conducive to the disorder before June or July, after which the decline in the soil moisture content restricts its development, even during hot weather, until the advent of damper conditions. In the final phase of the disease in late autumn, the falling temperature imparts a milder character to the symptoms, although the soil moisture remains at saturation point. On the basis of these data, appropriate conditions for roguing, which is best affected when the disease is at its height, can be forecast.

H. M. Moore discussed the bearing of weather conditions on the timing of the spraying schedules for the control of *Venturia inaequalis* on apple and *Sclerotinia laxa* on Morello cherries [ibid., xviii, p. 461].

Potato blight and the weather was the subject of a paper by A. Beaumont, based on extensive experience in Devon and Cornwall [ibid., xvii, p. 583].

T. H. Harrison summarized his conclusions regarding the influence of the widely variable climate of Australia on brown rot of stone fruits (*S. fructicola*) [ibid., xiv, p. 704].

Agriculture in Uganda.—xvi+551 pp., 30 pl., 8 figs., 1 graph, 5 col. maps, London, Humphrey Milford, Oxford University Press, 1940. 20s.

This handbook, stated in the introduction by J. D. Tothill to be intended as a companion volume to 'Uganda' (1935), presents in an attractive and readable form much valuable information on agriculture and cognate subjects, such as land tenure, climate, soils, and topography, each treated by an expert in the particular field under discussion, the work as a whole being 'in every sense a Departmental effort'. Fully descriptive observations on the etiology, symptomatology, mode of dissemination of the pathogens, varietal reactions, control, and other points of interest in connexion with the diseases of bananas, cassava, groundnuts, cotton, rice, coffee, sugar-cane, tea, tobacco, rubber, and other crops are contributed by C. G. Hansford, who also served as chairman of the committee set up under Government auspices to carry out the project.

Large (E. C.). **The advance of the fungi.**—488 pp., 6 pl., 52 figs., 3 diags., 2 graphs, 1 map, London, Jonathan Cape, 1940. 18s.

This excellent survey of the growth of the science of plant pathology, from its beginning in the eighteenth century to the present day, though written in language that an intelligent layman can understand, will be read with pleasure and profit by the most professional mycologist or plant pathologist.

The story is not written in strict chronological order, but consists of 31 chapters, including (i) The potato murrain, (ii) Famine in Ireland, (iii) *Oidium* on the vines, (iv) Fruits of the fungi, (v) The bunt of the wheat, (viii) Enter Louis Pasteur, (xv) Coffee rust in Ceylon, (xvii) Bordeaux mixture, (xxix) New sprays for old, and (xxxi) Towards immunity. There is a bibliography of 26 pages and an index of 12 pages.

Interest is added by including some background of political, economic, or social effects, comment on mycologists and others, touches of

humour and philosophy. The author writes with authority in his own field of chemistry, especially that of sprays and dusts, but he has prepared a well balanced, comprehensive, scientific treatise on the development of plant pathology.

Levine (A. S.) & Fellers (C. R.). **Action of acetic acid on food spoilage micro-organisms.** —*J. Bact.*, xxxix, 5, pp. 499-514, 1 pl., 1940.

Acetic acid in nutrient broth inhibited the growth of various micro-organisms associated with food spoilage in studies at the Massachusetts Agricultural Experiment Station, the effective concentration for *Aspergillus niger* being 0·27 per cent. (lethal at 0·59) at a P_H of 4·1 (lethal at 3·9) and for *Phytomonas* [*Bacterium*] *phaseoli* (inhibitory and lethal) 0·02 per cent. (P_H 5·2) [*R.A.M.*, xix, p. 667]. Acetic acid was more toxic to *A. niger* than either lactic or hydrochloric acid at a higher P_H value. In the presence of lactic acid at non-toxic concentrations the mould produced a heavy, rubbery mat unlike the growth formed with acetic or hydrochloric acid. It is concluded that the toxicity of acetic acid to the organisms under observation is a function, not only of the hydrogen ion concentration, but also of the undissociated acetic acid molecule.

Price (W. C.). **Acquired immunity from plant virus diseases.** —*Quart. Rev. Biol.*, xv, 3, pp. 338-361, 5 figs., 1940.

This is a fuller discussion of acquired immunity from plant virus diseases than that already noticed from another source [*R.A.M.*, xix, p. 487]. Most of the papers in the bibliography of 118 titles have been recorded from time to time in this *Review*.

Stanley (W. M.). **The biochemistry of viruses.** —*Ann. Rev. Biochem.*, ix, pp. 545-570, 1940.

The author reviews and discusses, with numerous references to the relevant literature, the information at present available on the biochemistry of viruses. The points dealt with include isolation methods, chemical composition of viruses, X ray studies, size and shape of viruses, and the properties of the tobacco mosaic virus. A bibliography of 180 titles is appended.

Bawden (F. C.) & Pirie (N. W.). **The inactivation of some plant viruses by urea.** —*Bio chem. J.*, xxxiv, 8-9, pp. 1258-1277, 1 graph, 1940.

Experimental evidence is presented demonstrating that the four viruses, tobacco mosaic, potato X, tomato bushy stunt, and tobacco necrosis were irreversibly denatured by urea [*R.A.M.*, xviii, p. 630], the process being accompanied by loss of infectivity and serological activity. For each virus there was a critical concentration of urea, below which no irreversible effect was exercised on infectivity. Inactivation was considerably expedited by the presence of alkali. The rate of inactivation was lowest at about 20° C. and greatly increased at 40°. The inactivation of purified tobacco mosaic virus by urea was only slightly slower than that of virus in crude infective sap.

Inactivation of tobacco mosaic and potato virus X, but not that of the remaining two viruses, was accompanied by separation of the nucleic acid and protein.

Bawden (F. C.) & Pirie (N. W.). **The effects of alkali and some simple organic substances on three plant viruses.**—*Bio-chem. J.*, xxxiv, 8–9, pp. 1278–1292, 1940.

Experiments are described in which a study was made of the effects of alkali, sodium dodecyl sulphate, urethane, guanidine, pyridine, picoline, lutidine, aniline, nicotine, phenol, sodium salicylate, sodium benzoate, and sodium hippurate on the viruses of tobacco mosaic and tomato bushy stunt, and some tests are also recorded on potato virus X [cf. *R.A.M.*, xviii, p. 266]. The effect of alkali [see preceding abstract] on tobacco mosaic virus is complex; treatment at P_H 9·3 may increase infectivity, at P_H 10·5 cause loss of infectivity but not serological activity, and at P_H 11 total loss of all characteristics. In the presence of alkali, sodium dodecyl sulphate readily destroyed the viruses, separating the nucleic acid from the proteins. Except nicotine and arginine, which formed with tobacco mosaic reversible, fibrous precipitates, all the material tested (at concentrations below 4M) inactivated the viruses in neutral solution.

Pirie (N. W.). **The criteria of purity used in the study of large molecules of biological origin.**—*Biol. Rev.*, xv, 4, pp. 377–404, 1940.

In this discussion on criteria of purity of substances such as plant virus proteins, the types of observation generally made and presented as evidence of purity are considered under seven headings. The least reliable methods are chemical analysis and crystallinity, while serological tests can only reveal the absence of suspected contaminants. The measurement of end points, whether by serum precipitation or infection, is subject to several errors, and at best can only indicate the possibilities of serological activity or infectivity of the major constituent of a preparation. Electrophoresis, ultracentrifugation, and solubility and partition measurements based on the principles of the phase rule are considered to afford the most satisfactory evidence of purity at present available, but there are various reasons to question the reliability even of these methods.

Wheldon (R. M.). **'Mutations' in Aspergillus niger bombarded by low voltage cathode rays.**—*Mycologia*, xxxii, 5, pp. 630–643, 4 figs., 1940.

When spores of *Aspergillus niger* were submitted to bombardment in vacuum by low-density beams of low-velocity electrons, comparable in density and range with the secondary electrons released in spore tissues under X-ray bombardment, variant strains were produced, mostly referable to five distinct types. One strain, when the spores were mature, varied in colour from avellaneous to wood-brown. A second, at the same growth stage, was Saccardo's umber. A third was mummy brown. A fourth, which was noted only twice, had a brilliant citron-yellow mycelium in the early growth stages, the older portions, as the culture matured, becoming pyrite-yellow, while the mature

spores were brownish, and much darker than the mycelium. The fifth was a 'giant' variant, the spores of which were black, but averaged 4 μ in diameter, as against 3·5 μ for the species and all the other variants. Continued through several asexual generations, these five variants showed no appreciable change. It was calculated that at the voltage used (about 12 electron kilovolts) the electrons penetrated deep enough to release most of their energy in the nuclear region. The evidence indicated that the observed effects were due to changes in the nucleus and may be regarded as mutations. In the large variant twice as many chromosomes were present as in the normal form, but in other respects the cytology of all the variants was the same as that of the species. Several repetitions of the experiments gave comparable results.

HENSON (L.). **The production of apothecia of Sclerotinia sclerotiorum and S. trifoliorum in culture.**—*Phytopathology*, xxx, 10, pp. 869–873, 1940.

The writer's technique for the production of stipes and apothecia by *Sclerotinia sclerotiorum* and *S. trifoliorum* [*R.A.M.*, iv, p. 481] consists in placing sclerotia of the two species on 1 per cent. water agar, slanted in 3·5 by 2 cm. vials tightly plugged with cotton, and leaving them without further attention under any desired conditions of light and temperature for six months or longer. In cultures kept out-of-doors at Lexington, Kentucky, *S. trifoliorum*, planted in the late summer, fruited most profusely from October to December, whereas *S. sclerotiorum*, initiated at the same time, did not mature until February to April. Observations on 105 isolates of *S. trifoliorum* and 28 of *S. sclerotiorum* showed that germination usually occurred in 75 to 85 per cent. of the cultures planted on any one date between 31st August, 1934, and 11th October, 1935, each sclerotium producing an average of over 1·5 apothecia. A temperature of about 14° C. was found to be the optimum for stipe formation in both species, the average exposures required for *S. trifoliorum* and *S. sclerotiorum* being 15 to 20 and 45 to 50 days, respectively (minimum 6 and 21, respectively).

A similar technique has been used for the development of the perfect stage of *Claviceps purpurea* [ibid., viii, p. 560], sclerotia of which from rye were planted on water agar on 11th September, one lot being placed outdoors and the other in a cold room at 3°; by the middle of the following April, part of each lot had produced stipes, while those outdoors had also matured and discharged ascospores.

LOUGHNANE (J. B.). **A survey of the aphis population of Potato crops in Ireland in relation to the production of seed Potatoes.**—*J. Dep. Agric. Éire*, xxxvii, 2, pp. 370–382, 1 graph, 1 map, 1940.

It is apparent from the results of the present survey that the number of potato-feeding aphids in the seed-producing areas in Counties Donegal, Sligo, Galway, Clare, Westmeath, Dublin, and Kildare is low, mainly owing to the scarcity of suitable winter food plants. Observations at the Albert Agricultural College, Glasnevin, point to the overwintering of *Myzus persicae*, the chief agent of virus transmission, in the viviparous state on winter crucifers [*R.A.M.*, xviii, p. 197], which

are only grown, however, in urban districts remote from the seed-producing areas in question, and are therefore unlikely to constitute a source of spring infestation by winged migrants. A further safeguard against the conveyance of viruses by this means lies in the atmospheric conditions of the coastal regions of the West of Ireland devoted to seed potato production, which appear to be generally unfavourable to aphid movement. It is practicable in these circumstances to maintain a high level of health in the seed-producing areas under discussion, which were, in fact, freed from leaf roll infection, introduced in new stocks, by the simple precaution of careful inspection and roguing. In the light of these data, the present situation in regard to the isolation of seed potato stocks in Ireland from potential sources of virus infection may be deemed satisfactory.

Ramsay (J. T.). **Raising the standard of Potato stocks.** —*J. Dep. Agric. Vict.*, xxxviii, 10, pp. 479–482, 7 figs., 1940.

In connexion with the establishment in Victoria of a potato seed certification scheme, notes are given on the following deviations from correct plant type or diseases against which growers must guard by thorough roguing: bolters, wildings [*R.A.M.*, xx, p. 30], *Rhizoctonia* [*Corticium solani*], blackleg (*Bacillus phytophthorus*) [*Erwinia phytophthora*], and the viruses (estimated to cause an annual loss of 25 to 30 per cent. in Australia) leaf roll (to which Up-to-Date is the most susceptible commercial variety under local conditions), mosaic, streak, and crinkle.

U.S.A. : surveys of Rubber producing possibilities in tropical American countries.—*Chron. bot.*, vi, 2, pp. 39–40, 1940.

A number of high-yielding varieties of *Hevea* rubber trees in tropical America have been found, in the course of an exploration of rubber-producing potentialities now in progress under the auspices of the United States Department of Agriculture, to be sufficiently resistant to the South American leaf disease [*Dothidella ulei*: *R.A.M.*, xv, p. 314; xix, p. 736] to reduce the seriousness of this factor, and the development of these strains on a commercial scale is planned.

Vandecaveye (S. C.) & Katznelson (H.). **Microbial activities in soil : VI. Microbial numbers and nature of organic matter in various genetic soil types.** *Soil Sci.*, l, 4, pp. 295–311, 3 graphs, 1940.

In continuation of studies which have been in progress for some years at the Washington Agricultural Experiment Station on the microbial activities of the soil [*R.A.M.*, xv, p. 174], the writers determined the numbers of bacteria, fungi, Actinomycetes, and cellulose decomposing bacteria in representative samples of various horizons of 15 soil types in relation to the nature and chemical composition of the humified organic matter. The average number of fungi was found to range from 2,133 to 738,750 per gm. of soil in the A, and from 1,313 to 258,750 in the B horizons. The soils supporting the most abundant fungal growth were various types of loam, notably Helmer silt, a brown forest soil developed on loessial material, bacteria tending to predominate in grassland. No significant relation was found to exist

between the total content of humified organic matter in the soils and their microbial populations.

KADOW (K. J.) & ANDERSON (H. W.). **A study of Horse-radish diseases and their control.**—*Bull. Ill. agric. Exp. Sta.* 469, pp. 531–583, 23 figs., 1940.

The following information concerning horse-radish diseases and their control in Illinois is presented as a result of studies initiated in 1933. White rust [or white blister] (*Albugo candida*) [*Cystopus candidus*: *R.A.M.*, xviii, p. 365] is the most destructive foliar disease of the crop. The physiologic race of the fungus [ibid., xiv, p. 1] occurring on horse-radish was shown by experiments in the authors' laboratory to attack only a few of the other crucifers investigated. The organism was found to overwinter in the crown and thence to infect the new shoots arising in the spring and developing into the hundreds of 'volunteers' commonly observed in fields planted to horse-radish in the previous year. It did not, however, penetrate to the point at which the lateral roots used for sets are produced, and overwintering through this channel is probably very rare in the Middle West, though field observations in 1940 show that this mode of perpetuation is not excluded, one plant in 1,000 in one field, and one in 5,000 in another developing the typical pustules of systemic infection in the absence of 'volunteers'. The results of four years' experiments in combating *C. candidus* by copper and sulphur sprays and dusts were not encouraging, and the most promising line of control is thought to consist in the development of resistant varieties of the Bohemian type.

Bacterial leaf spot (*Phytomonas* [*Bacterium*] *campestre* [var.] *armoraciae*) [ibid., viii, p. 543], first observed in Illinois in 1934, assumed a destructive form in the wet season of 1938, according to H. W. Anderson and Thornberry (*Plant Dis. Reptr*, xxii, p. 366, 1938).

Cercospora armoraciae Sacc., reported from Nebraska eastwards in the United States and from Canada, is sometimes responsible for severe injury to the leaves. The fungus is characterized by acicular, hyaline, 3- to 7-septate conidia, 100 to 180 μ in length, borne singly at the tips of simple, dark brown conidiophores, 30 to 40 μ long, and produces on the foliage pale grey spots, later darkening to nearly black, sometimes concentric lesions, $\frac{1}{2}$ to $\frac{3}{4}$ in. in diameter, which tend to coalesce and cover large areas of the leaf.

Ramularia armoraciae [*R.A.M.*, xviii, p. 365] appears from reports from Poland, the U.S.S.R., the United States, and Canada to be virtually co-extensive with its host. Like *C. armoraciae*, with which it is liable to confusion by reason of the similarity of the lesions, this fungus has not hitherto been considered sufficiently important to justify special control measures.

Minor foliar disorders of horse-radish are caused by *Alternaria brassicae* [? *A. oleracea*: loc. cit.] (rare in Illinois), *Macrosporium herculeum* [*A. brassicae*], the spots associated with which are much smaller than those of the foregoing, *Septoria armoraciae* [loc. cit.], inducing symptoms resembling those of *R. armoraciae* but not yet known to occur in America; *Phyllosticta armoraciae* (restricted to Europe); *P. decidua*, probably not a parasite but often observed in conjunction with other

leaf spots; *P. orbicula*, recorded from Ontario and New York as the agent of a small, definite, white spot with sparse pycnidia; surface mildew (*Erysiphe polygoni*) [loc. cit.], uncommon in America; downy mildew (*Peronospora parasitica*) [ibid., xvi, p. 360]; black streaking of the leaf petioles, originating in the form of spots $\frac{1}{8}$ to $\frac{1}{4}$ by $\frac{1}{16}$ in. which gradually elongate into coalescent, sunken streaks, 1 to 2 in. long, extending from below the epidermal layer into the cortex to a depth of five or six cells, where a gum-like, dark brown deposit is formed (this condition is almost universal in the cultivated horse-radish, and if it constitutes a form of mosaic [ibid., xii, p. 351; xiv, p. 731], most commercial plantings must be regarded as virus-infected); and chlorosis of genetic origin, observed in Illinois and also reported (*in litt.*, 1935) by Baudyš from Czechoslovakia and Schleyer from Germany (*Vjschr. Bayer. LandwRat.*, xii, pp. 1–68, 1907).

Virus diseases, besides mosaic, include curly top, also known as 'brittle root' [ibid., xvi, p. 225] or 'wilt' and possibly a form of deterioration or 'running-out' of 'old-line' (home-grown) sets, the infective principle presumably increasing in the latter through asexual propagation from year to year. In 1938 and 1939 the yields at Collinsville from sets originating in the north of the State in the same years were over 115 per cent. heavier than those from the local stock, while even after four years of transplantation the former were still giving an increase of 54 per cent. over the latter.

The etiology of 'root blackening', 'core rot', and 'red brittleness' [ibid., xvi, p. 361] is obscure, the first-named probably comprising several distinct troubles, including curly top. Experiments are described showing that an important part in the development of root rots is played by injuries inflicted in the process of 'lifting', a commercial practice involving the removal of the side roots from the cuttings once or twice during the summer, usually under moist conditions, leaving only those at the extreme end to absorb nourishment for growth: in one test 21 per cent. of unmarketable and 87 per cent. diseased roots were counted as a result of this treatment, compared with only 2 per cent. unmarketable and 11 per cent. diseased in an undisturbed planting.

The importance of the root rot problem in Illinois was thought to justify a study of the factors concerned, which was undertaken by C. Wutzke, who states (in an unpublished report) that over 60 bacteria were isolated from the material at his disposal, many capable of causing decay independently, while others did so only in various combinations. *P.* [*Bact.*] *phaseoli* was the only one of these organisms previously described as the agent of a vegetable disease, and cross-inoculation experiments with this pathogen resulted in the development of typical blight lesions on bean [*Phaseolus vulgaris*] leaves and 'core rot' of horse-radish. A common symptom of internal bacterial infection is a stringy mass of fibres in the core; a few of the species isolated were able to destroy the epidermal and cortical cells. Incipient vascular discoloration and epidermal decay of bacterial origin are prevalent in stored roots and sets.

Pötschke attributed the above-mentioned root blackening to a species of *Verticillium* [ibid., iii, p. 11; cf. ibid., xvii, p. 10], whereas other

workers regard this disturbance as non-parasitic: in all probability these conflicting opinions arise from the fact that there are several root rots of diverse origin with virtually identical symptoms requiring cultural and pathogenicity tests for their accurate diagnosis.

Rhizoctonia root rot of horse-radish occurs in various parts of the United States. The species concerned in Czechoslovakia was identified by Baudyš (*in litt.*, 1935) as *R. violacea* [*Helicobasidium purpureum*], the pathogenicity of which and its amenability to control by finely ground sulphur and germisan were demonstrated. The writers have also obtained good results with 325-mesh sulphur dust. A species culturally and morphologically similar to *R.* [*Corticium*] *solani* was isolated from horse-radish in Illinois and shown by inoculation tests to be parasitic on the same host. In 1934 and 1935 it caused heavy losses in roots and sets stored in pits. Infection usually takes place at the crown or through wounds in the roots. Limited observations suggest that *C. solani* is an important factor in the development of rot in roots exposed to direct sunshine in the pits, entry being effected through shoots that have sprouted prematurely and have been killed by frost. The diseased tissues are pale yellow to light dirty grey and friable; in advanced stages black sclerotia may be detected among the white mycelium.

The species of *Penicillium* [cf. ibid., xvi, p. 361] associated with a prevalent root rot of horse-radish in Illinois, covering the surface with its greenish-blue spore masses and causing an average loss of 2 to 10 and a maximum of 40 per cent., was identified by C. Thom as *P. hirsutum* Dierckx. It gave positive results in inoculation tests on stored roots only, denoting that its parasitism is of a weak order. Like the very similar disease caused by *C. solani*, the *Penicillium* root rot may be combated by dusting with sulphur. Both *Rhizoctonia* and *Penicillium* rots are serious, in some seasons causing losses of 50 per cent. of the crop.

Thielavia [*Thielaviopsis*] *basicola* is reported to have caused substantial damage to the New Jersey horse-radish crop.

Minor root disorders include waterlogging of the roots (in Germany and Czechoslovakia), girdle disease (Germany) [ibid., ix, p. 156], club root (*Plasmodiophora brassicae*), first reported from Germany in 1907 and also occurring in Illinois, *Pezizella dilutella* and *Lachnum sulphureum* in Germany, *Gibberella saubinetii* and *Fusarium oxysporum* in Denmark, *Rhizopus nigricans* in Illinois, hollow root, first reported from England in 1888 and serious in Illinois in 1934, and *Sclerotinia sclerotiorum* and *Pseudomonas* [*Bact.*] *tumefaciens* in Germany [ibid., xvi, p. 361].

The paper concludes with a table showing the distribution of the various diseases in the United States, with the authority and date for the first observation in each case, and a bibliography of 116 titles.

Drummond (O. A.). **Enrolamento das folhas da Cana de Acúcar.** [Leaf roll of Sugar-Cane.]—*Ceres*, i, 1, pp. 71–73, 2 figs., 1939. [English summary. Received December, 1940.]

Myriogenospora paspali (which the author, following Diehl, regards as identical with *M. aciculisporae* [*R.A.M.*, xiii, p. 706]) was observed

in Minas Gerais, Brazil, for the first time in the province, in 1938, causing a leaf disease of sugar-cane of minor economic importance [ibid., xviii, p. 624]. The outer leaves split longitudinally and adhere tightly to the inner ones instead of unfurling normally. *Paspalum conjugatum* and *Imperata brasiliensis* are other local hosts of the fungus.

Ramsbottom (J.). **Taxonomic problems in fungi.**—*ex* New Systematics, Oxford, Clarendon Press, pp. 411–434, 1940.

In this contribution the author reviews from the taxonomic standpoint the advance of knowledge in the fungi with regard, *inter alia*, to saltation, dual phenomenon, heterothallism, hyphal anastomosis and hybridity, specialized parasitism (in the rusts), hybridity in smuts, and morphological classification of the Basidiomycetes.

Cummins (G. B.). **Descriptions of tropical rusts—III.**—*Bull. Torrey bot. Cl.*, lxvii, 7, pp. 607–613, 2 figs., 1940.

This is a critically annotated list of 21 Guatemalan rusts, of which nine are new [with Latin diagnoses]. *Cumminsiella standleyana* n.sp. on *Berberis fascicularis* differs from the related *C. sanguinea* [*R.A.M.*, xviii, p. 654] in the scattered pores of its uredospores and the shorter and more fragile pedicels of the teleutospores. *Peridermium montezumae* n.sp. occurs on *Pinus montezumae*.

Kern (F. D.) & Thurston (H. W.). **A further report on the Uredinales of Colombia.**—*Mycologia*, xxxii, 5, pp. 621–629, 1940.

Critical and taxonomic notes are given on 22 species of Colombian rusts, this list adding 11 to the number reported in 1933 [*R.A.M.*, xiii, p. 326], and bringing the total up to 226. Two new species are included, together with *Puccinia capsicicola* nom. nov. (*Aecidium capsici* Kern & Whetzel, *J. Dep. Agric. P. R.*, xiv, p. 341, 1930, not *P. capsici* Major, *Mém. Soc. neuchâtel. Sci. nat.*, v, p. 501, 1913).

Hiratsuka (N.). **Additional notes on Uredinales of Shikoku.**—*J. Jap. Bot.*, xvi, 6, pp. 327–329, 1940.

Continuing his studies on the rust flora of Japan [*R.A.M.*, xix, p. 729], the author enumerates a further ten species supplementary to his earlier list of Uredinales of Shikoku (*Mem. Tottori agric. Coll.*, iii, pp. 249–377), among which may be mentioned *Chrysomyxa tsugae* on *Tsuga sieboldii* [*R.A.M.*, xvii, p. 347] and *Puccinia lolii* [*P. coronata*] on *Avena fatua*. Six new rust hosts are also listed, including *Anemone nikoënsis* for *Tranzschelia* [*P.*] *pruni-spinosae* [ibid., xix, p. 418].

Seeler (E. V.). **A monographic study of the genus Thyronectria.** *J. Arnold Arbor.*, xxi, 4, pp. 429–460, 5 pl., 1940.

This monograph opens with a critical taxonomic discussion of the characters of the genus, following which are descriptions of 16 species of *Thyronectria* [*R.A.M.*, xix, p. 734], including three new ones [with Latin diagnoses] and eight new combinations. A new subgenus *Gyrostromella* [with a Latin diagnosis] is erected to accommodate the species of *T.* with *Gyrostroma* as their conidial stage.

Mendoza (J. M.) & Leus-Palo (Simeona). **A revision of the genus Psalliota in the Philippines.**—*Philipp. J. Sci.*, lxxii, 3, pp. 337–347, 8 pl., 1940.

Fries's interpretation of the name of *Psalliota* as comprising only Agarics with purple or reddish spores, more or less fleshy plants, and free gills, in contradistinction to Linnaeus's conception of *Agaricus*, characterized by varicoloured spores, membranaceous, persistent gills, and a floccose, putrefying trama, is applied to the revision of 13 species occurring in the Philippines, involving the establishment of three new combinations. *P. campestris* was introduced into the country as a result of the attempted cultivation of this species with imported spawn and large quantities of it have been gathered in Pasig, Rizal Province.

Padwick (G. W.). **The genus Fusarium III. A critical study of the fungus causing wilt of Gram (Cicer arietinum L.) and of the related species of the subsection Orthocera, with special relation to the variability of key characteristics.**—*Indian J. agric. Sci.*, x, 3, pp. 241–284, 1940.

In continued studies on the genus *Fusarium* [*R.A.M.*, xviii, p. 780] cultures from Baarn of all but one of the twelve species or forms comprising the subsection *Orthocera* (the twelfth, *F. conglutinans* var. *citrinum* not being available) were examined in comparison with the three fungi causing wilt of gram (*Cicer arietinum*) in India [loc. cit.]. The results obtained are fully tabulated and show that in respect of pigment production, which was best observed on steamed rice, the cultures fall into three groups: (i) *F. orthoceras* var. *pisi*, producing blue or brown pigment, unaffected by the addition of hydrochloric acid or potassium hydroxide; (ii) *F. bostrycoides*, *F. orthoceras* and its varieties *apii* and *longuis*, *F. angustum*, and *F. lini*, producing a purple pigment, becoming red in hydrochloric acid and blue or violet in potassium hydroxide; and (iii) *F. conglutinans* and its varieties *betae* and *callistephi*, *F. orthoceras* var. *apii* f. 1, and the fungi causing gram wilt, none of which produce any pigment. The cultures varied greatly in the amount of aerial mycelium produced, but no specific relationship could be established. The production of aerial mycelium as well as of a stroma, and the size of non-septate spores are considered of no diagnostic value. Except in the case of *F. orthoceras* var. *apii* f. 1, the only effect of temperature on pigment production was a slightly more rapid appearance of colour and a tendency towards a slightly more violet hue at the higher temperatures. *F. orthoceras* var. *apii* f. 1 produced no pigment at 10°, 15°, 30°, and 35° C.; at 20° it produced a purple aerial mycelium and a dark plumbeous discoloration of the substrate, while at 25° one culture produced a slight patch of pigment at the top of the plant. In general, all cultures showed the greatest amount of aerial mycelium at 20°, 25°, and 30°, less being produced at 35° and very little at 10°. All cultures except *F. bostrycoides* had a thin plectenchymatous stroma, which in most cases was present at all temperatures except at 10°. The only culture showing a thin pionnotal layer of spores was that of *F. conglutinans* var. *callistephi*, which was placed by Wollenweber and Reinking in the group with pionnotes typically absent. Temperature had but little effect on the number of septations

or the length of conidia, but chlamydospore production was markedly better at 35° than at 20°. Variable results were obtained as to the influence of asparagine on septation or spore length in five strains tested.

It is concluded from the results of these studies that the key supplied by Wollenweber and Reinking for the identification of species of the *Orthocera* group is of no use with authentic cultures, since all of the major characteristics proved to be unstable. It is suggested that the original description of *F. orthoceras* covers *F. conglutinans* and its varieties *betae* and *callistephi*. The new combinations *F. orthoceras* App. & Wollr var. *conglutinans*, *F. orthoceras* App. & Wollr var. *betae*, and *F. orthoceras* App. & Wollr var. *callistephi* are, therefore, proposed for *F. conglutinans*, *F. conglutinans* var. *betae*, and *F. conglutinans* var. *callistephi*, respectively. The three fungi are stated to be morphologically indistinguishable from the fundamental species and to differ only in pathogenicity. The fungi causing wilt in gram are considered to comprise one variety, for which the name *F. orthoceras* App. & Wollr var. *ciceri* is proposed. According to the author's measurements the variation in spore size in *F. lini* is much greater than indicated by Wollenweber and Reinking, and their view that this species is a transitional form with other groups is not accepted. Some doubts are expressed with regard to the position of *F. angustum* which Wollenweber and Reinking had retained in the subsection *Orthocera* in spite of the shape and the length to breadth ratio of their spores which place them quite outside this group and rather point to the *Constrictum* subsection. *F. bostrycoides* was in no case observed to show the characteristic bostrycoid branching which gave it its name, but had a very distinct tendency to produce conidia in false heads. It is thought advisable to retain this species for the time being.

De Haan (I.) & Schoorel (A. F.). **Kaligebrek in de Theecultuur.** [Potash deficiency in Tea cultivation.]—*Arch. Theecult. Ned.-Ind.*, xiv, 2, pp. 43–81, 2 col. pl., 3 figs., 9 graphs, 1 map, 1940. [English summary.]

Tea bushes affected by potash deficiency, stated to be prevalent in west Java and along the west coast of Sumatra, may be recognized by the premature shedding of the leaves of the basal branches, towards the tips of which, however, foliar production continues on a reduced scale. The leaf margins are scorched and frequently invaded by various fungal blights, including *Pestalozzia theae*, these symptoms being sometimes preceded by the development of a dark bronze-green cast over the same area. The typical features of the disorder, as observed in the field, were artificially induced in tea seedlings grown in pot cultures in quartz sand with a synthetic nutrient solution from which potash was omitted, while leaf ash and soil analyses afforded further confirmation of the view that lack of available potash is at the root of the trouble on the affected estates. A close correlation was apparent between the external symptoms of potash shortage and the amount of the element present in the leaf ash, less than 10 per cent. potassium oxide usually accompanying severe damage while normal growth was made in the presence of upwards of 20 per cent. Soils with a potassium oxide content below

0·007 per cent. gave rise to deficiency symptoms while the beneficial effects of potash manuring (200 gm. potassium sulphate per sq. m.) were experienced in those with up to 0·017 per cent.; the disappearance of the abnormal symptoms under this treatment was accompanied by an increase in leaf production, as well as in the potassium oxide content of the foliage.

Schoorel (A. F.). **Kaligebrek in de Theecultuur II.** [Potash deficiency in Tea cultivation II.]—*Bergcultures*, xiv, 42, pp. 1336–1339, 2 graphs, 1940.

Further information is presented concerning the pathological condition of tea plantations situated on potash-deficient soils in Java and Sumatra [see preceding abstract], most of those in the former region being of the reddish- to yellowish-brown, very permeable, weathered andesite-tufa-laterite types, and in the latter volcanic pseudo-sand. Small applications of potash were of little benefit in the correction of the trouble, an annual dose of 15 to 25 gm. potassium sulphate per plant being regarded as essential to maintain the gardens in a satisfactory state of health where incipient signs of shortage have been observed. Drastic pruning is poorly tolerated by bushes suffering from lack of potash, and the shoots should not be cut back to a length exceeding 60 cm. during the period of rehabilitation; in one test the incidence of mortality among bushes pruned back to distances of 40, 60, 80, and 100 cm. was 0, 0·3, 2·3, and 16 per cent., respectively. Increased leaf production of 45, 19, and 61 per cent. above the control resulted from the experimental application of three potash-containing fertilizers.

Pfältzer (A.). **Een voorloopige mededeeling over de zgn. 'bitten-off disease', een ziekte bij Theekweekplanten.** [A preliminary note on the so-called 'bitten-off disease', a disease of nursery Tea plants.] —*Bergcultures*, xiv, 43, pp. 1364–1365, 1 fig., 1940.

From the rootlets of tea seedlings showing 'bitten-off' symptoms [*R.A.M.*, xix, p. 677] at the Malang and West Java Experiment Stations, as well as from similar material in the Tjibadak district and east Java, a species of *Pythium*, as yet undetermined, has been isolated and proved by inoculation experiments to be a virulent parasite, especially on unsterilized soil. The soil used for these tests was rather less acid (P_H 6·65) than Gadd's optimum for the growth of tea (P_H 5·3 to 6·5), but yielded vigorous seedlings, and no evidence was obtained that insufficient acidity is the primary factor in the development of the 'bitten-off' condition.

Laufeer (M. A.) & Stanley (W. M.). **Die Kolloidchemie des Tabakmosaikvirus.** [The colloid chemistry of the Tobacco mosaic virus.] —*Kolloidzschr.*, xci, 1, pp. 62–70, 1 fig., 2 diags., 7 graphs, 1940.

Recent outstanding contributions to the knowledge of the tobacco mosaic virus are summarized with emphasis on its utility as an adjunct to the solution of colloid-chemical problems.

Valleau (W. D.). **Classification and nomenclature of Tobacco viruses.** —*Phytopathology*, xxx, 10, pp. 820–830, 1940.

This is a discussion of the eight viruses causing disease in commercial tobacco plantings in Kentucky, viz., tobacco mosaic, etch, cucumber mosaic, tobacco streak, veinbanding, tobacco ring spot, tomato spotted wilt, and tobacco leaf curl, of which the first four are regarded as unrelated to any others and are accordingly transferred to the new genera *Musivum*, *Foliopellis*, *Murialba*, and *Tractus* as *Musivum tabaci* n. comb., *F. erodens* n. comb., *Murialba cucumeris* n. comb., and *T. orae* n. comb., respectively. For the tobacco ring spot virus (*Annulus tabaci* Holmes) the author thinks it would be preferable to use the laboratory name and disregard the latinized name, and he rejects the family Annulaceae [*R.A.M.*, xviii, p. 607] as based on a spurious recovery. The veinbanding virus is raised to specific rank as *Murialba venataenia* n.sp. (*Marmor cucumeris* var. *upsilon* Holmes).

Of the three proposed systems of virus nomenclature, viz., J. Johnson's [ibid., vi, p. 501], K. M. Smith's [ibid., xvii, p. 52], and Holmes's, the last-named is preferred, though with certain reservations, and adopted wherever possible. The relative merits of the serological and immunity reaction (protective) methods of virus classification are discussed.

Hean (Miss A. F.). **Kromnek in South Africa. Its host range and distribution.**—*Fmg S. Afr.*, xv, 175, pp. 388–390, 3 figs., 1940.

In this account of the host range and geographical distribution of 'kromnek' disease [*R.A.M.*, xix, p. 196] in South Africa, the author states that cos lettuce has not so far been found naturally infected, even when growing between two severely affected tomato plantings, and only with great difficulty has it been artificially infected. Sweet peas and other leguminous plants growing next to diseased tomatoes have never been observed to be affected. All attempts to infect petunias systemically gave negative results.

A virus disease which from its properties and host range appears to be closely related to kromnek is fairly common in the vicinity of Pretoria, and may be present in the Kat River area of Cape Province. The chief host is the petunia, to which this disease is readily transmitted by the usual methods, systemic infection becoming apparent shortly after inoculation. With kromnek, on the other hand, only small, brown necrotic spots are obtained on inoculated petunia leaves, and in no instance was petunia observed to show these spots naturally.

Tomato varieties resistant to spotted wilt in California showed no greater resistance to kromnek in South Africa than did the ordinary commercial varieties commonly grown in the latter country. *Lycopersicum pimpinellifolium* developed 20 per cent. natural infection when planted out in Pretoria.

A type of tobacco resistant to a virus disease found in South America and apparently closely related to spotted wilt was ascertained to be as susceptible to kromnek as the ordinary commercial varieties. The plants died off completely a few days after the symptoms had appeared.

As many hosts of kromnek are perennials or vegetatively propagated,

e.g., dahlias, *Stapelia* spp., *Erlangea tomentosa* (imported from East Africa), and *Medicago* sp., a reservoir of infected plants is always present from which the disease may be spread in summer.

The paper terminates with an annotated list of the known hosts of kromnek and a list of the localities affected in South Africa.

Grooshevoy (S. E.), Khudyna (I. P.), & Popova (Mme A. A.). Термический метод обеззараживания семян Табака и Махорки. [Thermal method for disinfecting Tobacco and Indian Tobacco seeds.]—*Всесоюзн. научноиссл. Инст. Табачн. Махорочн. Пром. им. А. И. Микояна* (*ВИТИМ*). [*The A. I. Mikoyan pan-Soviet sci. Res. Inst. Tob. and Indian Tob. Ind.* (*VITIM*)], *Rostoff-on-Don, Publ.* 141, pp. 3–29, 1940. [English summary.]

In the course of seed disinfection experiments carried out during the years 1935 to 1939 [*R.A.M.*, xvii, p. 711], the best results were obtained by heating the seeds (packed in 0·5 or 1 kg. sacks) for one hour at 85° to 90° C. after drying them, preferably at 40° to 42° for two to four days, so that their moisture content is reduced to less than 6 per cent. No improvement resulted from heating at 100° for the same period or at 80° for five hours. In seeds treated by this thermal method infection by *Fusarium* sp. and *Botrytis cinerea* was completely controlled. The incidence of *Bacterium tabacum* in tobacco and Indian tobacco [*Nicotiana rustica*] plants grown from treated seeds was, on the average, 3·7 and 5·8 per cent., respectively, as compared with 6·9 and 10 per cent. in the untreated controls. It was experimentally found that the thermal method was twice as effective in controlling *Bact. tabacum* as treatment with silver nitrate (1 : 1000) or formalin (1 : 50). The authors also claim that the thermal method reduces by half the incidence of various seed-borne virus diseases. The germinability of seed stored after harvest for one to two years was not impaired by subsequent drying or heating; of the seeds stored for longer periods some, particularly variety Dubeck 44, suffered through heating, while others did not lose their germinability even after three years' storage. It is advised, therefore, before applying the thermal method to older seeds, to test a small quantity of them for their reaction to heating.

In farm experiments it was shown that an average increase in yield of 15·6 per cent. for tobacco and 13·4 per cent. for Indian tobacco resulted from the use of heated seeds.

Grooshevoy (S. E.), Levykh (P. M.), Roozinoff (P. G.), & Nicolayeva (Mme R. G.). Химический метод обеззараживания парникового субстрата. [Chemical method of disinfecting seed-bed soil.]—ibid., pp. 30–41, 1940. [English summary.]

The results of experiments carried out during 1937 to 1939 in the Crimea and in Krasnodar show that the application of chloropicrin [see below, p. 93] to tobacco seed-bed soil at the rate of 0·5 l. per cu.m. of soil reduced the percentage of seedlings infected with *Thielaviopsis basicola* [see next abstracts] from 89·0 to 1·5, and at rates of 0·75 or 1 l. per cu.m. the disease was completely controlled. Applying

chloropicrin to moderately moist soil (of about 60 per cent. saturation) at a temperature of above 15° C. was more satisfactory than applying it to either moister or drier soil at lower temperatures. The best method, and the least dangerous to men and animals in the vicinity, consisted in adding chloropicrin to the compost placed in pits (which can be covered up) at the rate of 0·5 l. per cu.m., preferably in autumn in sufficiently warm weather. The application of chloropicrin also considerably reduced the growth of various weeds, but was in that respect not as effective as thermal treatment of seed-bed soil [*R.A.M.*, xv, p. 751].

Grooshevoy (S. E.) & Levykh (P. M.). Возможность получения незараженной парниковой смеси в компостных кучах. [The possibility of obtaining seed-bed soil free from infection in compost heaps.]—ibid., pp. 42–48, 1940. [English summary.]

This is a preliminary account of experiments carried out during 1939, in which it was found that compost heaps of various compositions prepared for tobacco seed-beds [cf. preceding and next abstracts] developed in all but their outer layer (of 10 cm. thickness) temperatures, varying from 49° to 63° C., which were lethal to spores of *Thielaviopsis basicola*, pseudosclerotia of *Rhizoctonia* sp., seeds of various weeds, and to the virus of tobacco mosaic [but see *R.A.M.*, xiii, p. 188]. It is, therefore, considered possible, by adjusting the composition of the heaps and by improving the method of composting generally, to obtain seed-bed soil completely free from the agents of the main diseases of tobacco.

Grooshevoy (S. E.), Levykh (P. M.), & Malbieva (Mme E. I.). Режим обеззараживания парниковой смеси даровыми источниками тепла. [Methods of disinfecting seed-bed soil by natural sources of heat.]—ibid., pp. 49–61, 1940. [English summary.]

In further experiments on the disinfection of tobacco seed-bed soil [see preceding abstracts] conducted during 1939 and 1940, it was shown in laboratory tests that chlamydospores of *Thielaviopsis basicola* fail to germinate after being heated at constant temperatures of 40°, 45°, 50° to 55°, 60°, 65°, 70°, and 75° C. for 115, 48, 24, 6, 5, 4, and 1½ hours, respectively, or after being heated three hours a day at 45° during 5 days or at 50° during 3 days. The pseudosclerotia of *Rhizoctonia* sp. failed to germinate after being heated at 45°, 50°, 55°, and 60° for 48, 10, 8 hours, and ½ hour, respectively, or for three hours a day at 45° during 3 days. The sclerotia of *Sclerotinia libertiana* [*S. sclerotiorum*] failed to germinate after being heated at 45° and 50° to 55° for 36 hours and 1 hour, respectively, or for three hours a day at 45° during 3 days. It is concluded from these results that the temperatures developing within compost heaps and solar energy directed on seed-bed soil in cold frames [*R.A.M.*, xviii, p. 635] can ensure freedom from spores of the chief causal agents of tobacco diseases, provided, in the first case, a temperature of not less than 45° obtains in the heap for five days, or, in the second case, the soil in the cold frame is heated

by the sun during the hottest hours of the day to from 45° to 50° for the same period. Higher temperatures or longer exposures are necessary to ensure the destruction of most weed seeds.

Grooshevoy (S. E.) & Popova (Mme A. A.). Протравливание корней рассады перед посадкой как мера борьбы с болезнями Табака и Махорки. [Treatment of seedling roots before transplanting in the control of Tobacco and Indian Tobacco diseases.]—ibid., pp. 62–77, 1940. [English summary.]

In further experiments on the control of tobacco diseases [*R.A.M.*, xviii, p. 635] in which various chemicals were tested on a number of farms from 1937 to 1939, the best results were obtained by dipping the roots of tobacco and Indian tobacco (*Nicotiana rustica*) seedlings before replanting in 1 per cent. Bordeaux mixture. In tobacco, the incidence of bacterial 'ryaboukha' (*Bacterium tabacum*) was almost completely controlled (the infection ranging from 0·8 to 50 per cent. in the untreated control, and from 0 to 2·7 per cent. in the treated lots), that of black root rot (*Thielaviopsis basicola*) [see preceding abstracts] reduced on the average 2·4 times (from 0·6 to 63·2 per cent. in the untreated control to 0·05 to 38·1 per cent. in the treated lots), that of tobacco mosaic 4 to 5 times (from 1·4 to 42 per cent. in the untreated control to 0 to 10·8 per cent. in the treated lots), and that of *Phyllosticta* [ibid., x, p. 628] from 2·1 per cent. in the untreated control to 0·3 per cent. in the treated lots. In Indian tobacco, the incidence of *Bact. tabacum* was reduced from 3·0 to 63·5 per cent. in the untreated control to 0 to 36 per cent. in the treated lots), and that of ring spot (virus) 1·6 times (from 3 to 68 per cent. in the untreated control to 0 to 48·5 per cent. in the treated lots). In regions of sufficient moisture, the dipping of seedling roots in disinfectant had no harmful effect on the subsequent development of tobacco and Indian tobacco plants in the field and sometimes even improved the yields, particularly when the seedlings were treated at the stage of normal maturity; in dry regions, however, the treatment resulted in thinner stands, especially if the seedlings were treated when too small or over-mature. The treatment is therefore recommended only for the wet zone or for low-lying, moist areas in the dry one.

Popova (Mme A. A.). Влияние удобрений на поражаемость Махорки бактериальной рябухой и заразихой. [The effect of fertilizers on the infection of Indian Tobacco with wildfire and Broomrape.] —ibid., pp. 158–175, 1940. [English summary.]

According to a survey completed in 1938, bacterial 'ryaboukha', referred to by the author as wildfire [*Bacterium tabacum*: see preceding and next abstracts] is the most prevalent disease of Indian tobacco (*Nicotiana rustica*) in the Ukraine, infecting 62·7 per cent. of the inspected area and occurring usually in a severe or moderately severe form. In field trials conducted from 1936 to 1938, it was found that the application of potassium and nitrogen fertilizers to the soil generally reduced the amount of wildfire in *N. rustica* whereas dressings of phosphate often increased it. While the application of a combined nitrogen-potassium fertilizer reduced the percentage of infected plants

from 48·7 in the untreated plots to 9·7, the addition of phosphate in various forms to that fertilizer resulted in much less satisfactory control. The best results in controlling wildfire as well as *Orobanche ramosa* were obtained by applying the complete nitrogen-phosphorus-potash fertilizer in the autumn in the proportions 300 : 100 : 200, which reduced the percentage of infected plants from 7 in the untreated control to 0 and increased the average plant weight from 93·3 to 327·1 gm.; and 600 : 180 : 300, reducing the percentage of infected plants from 14 to 0·5 and increasing the average plant weight from 99·2 to 195·6 gm.

Popova (Mme A. A.). Приемы агротехники в борьбе с бактериальной рябухой Махорки. [Agrotechnical methods in the control of wildfire of Indian Tobacco.]—ibid., pp. 176–195, 1940. [English summary.]

The following agricultural practices were found from 1932 to 1938 to exert an effect on the incidence of bacterial 'ryaboukha' or wildfire [*Bacterium tabacum*: see preceding abstracts] on Indian tobacco (*Nicotiana rustica*). Plants sown directly in the field were usually more affected (1·4 to 5·2 per cent.) than those transplanted from the seed-bed (1·0 to 3·4 per cent.), except in isolated years with a particularly early outbreak of wildfire, when the case may be reversed. Early planted Indian tobacco showed less infection (31·2 to 33·2 per cent.) than late planted (40·1 to 50·8 per cent.), the same difference being observed between the early and late dates of sowing (3·0 to 22·5 as compared with 5 to 35 per cent.). A reduction in the amount of the disease from 53·2 to 12·2 per cent. was obtained by loosening the soil between the rows every six days as compared with control plots in which weeds were cut down without disturbing the soil. With plants sown directly in the field, thinning out in the phase of the fourth to sixth leaf resulted in less disease than when postponed to later dates. Planting of protective rows decreased the amount of infection from 30 in the unprotected plants to between 5·3 and 12·5 per cent. Growers are advised to plant such protective rows to the windward, and to use plants taller than Indian tobacco. Indian tobacco cultivated on the same field for two to three years in succession suffered more from wildfire than when grown in rotation, particularly with leguminous crops.

Grooshevoy (S. E.) & Levykh (P. M.). Химический метод борьбы с мучнистой росой Табака. [Chemical method of controlling powdery mildew of Tobacco.]—ibid., pp. 78–97, 1940. [English summary.]

Powdery mildew of tobacco [*Erysiphe cichoracearum*: *R.A.M.*, xvi, p. 214] is stated to cause usually considerable losses in the tobacco-growing districts of Russian Central Asia, and occasionally in the Crimea, Abkhazia, Black Sea littoral, Krasnodar, and Transcaucasia. In field trials of fungicides for the control of this disease carried out in 1938–9, the highest yields and generally best results were obtained by spraying tobacco plants with lime-sulphur (20 per cent. Baumé) at a concentration of 1 in 100. The spraying impaired the smoking quality of tobacco somewhat, but to a less degree than did the powdery mildew.

Levykh (P. M.). Влияние температуры и влажности воздуха на поражаемость Табака мучнистой росой (**Oidium tabaci Thuem.**). [The influence of temperature and air humidity on the infection of Tobacco by powdery mildew (*Oidium tabaci* Thuem.).]—ibid., pp. 97–111, 1940. [English summary.]

The oidia of *Oidium tabaci* [*Erysiphe cichoracearum*: see preceding abstract] were found to germinate readily when, in the course of experiments in 1938–9, they were placed on dry slides in a moist chamber, but not in drops of water. The optimal temperature for germination was 11° to 25° C., none occurring at 1·9° to 4·8° or at 41°. Under optimal temperature conditions germination was best at relative air humidities from 60 to 100 per cent. The optimal conditions for the infection of tobacco plants with *E. cichoracearum* obtained at a relative air humidity of 60 to 75 per cent. at temperatures between 16° and 23·6°, the minimum being 10° and the maximum 26·2°. Under natural conditions, however, infection occurs even when the day temperature rises above 26·2° provided that the optimal range (18° to 19°) obtains by night. Inoculated tobacco plants exposed to an air humidity of 100 per cent. and optimal temperatures showed no external signs of infection after six days, but the symptoms developed and the oidia appeared when the air humidity was lowered to 70 to 76 per cent. The oidia quickly lost their germinability in storage, the loss of virulence being most rapid at 19° to 21° and at an air humidity of 40 to 58 per cent., and slowest at 14°. Only those oidia stored at an air humidity of 80 to 89 per cent. survived for 12 days.

Khudyna (I. P.). Отношение сортов **Nicotiana tabacum L.** и некоторых видов **Nicotiana** к заражению вирусом Табачной мозаики **(Nicotiana virus 1 (Mayer) Allard)**. [The reaction of some *Nicotiana tabacum* L. varieties and some *Nicotiana* species to infection with Tobacco mosaic virus (*Nicotiana* virus 1 (Mayer) Allard).]—ibid., pp. 112–124, 1940. [English summary.]

None of the 711 varieties of tobacco belonging to different genetic groups tested in varietal trials from 1933 to 1939 showed resistance to the virus of tobacco mosaic, although they exhibited considerable differences in the degree of malformation and the character of mottling. The variety Ambalema received from Nolla and Valleau [*R.A.M.*, xvii, p. 417] was found to be highly resistant to three strains of the virus (severe, yellow, and mild). Of the other species of *Nicotiana* tested, *N. glutinosa* completely localized the virus in primary necrotic lesions; *N. rustica*, *N. langsdorffii*, *N. alata*, *N. sanderae* and others showed necrotic spots on infected leaves followed by systemic infection leading often to death of the plant; systemic infection with mottling was exhibited by *N. sylvestris*, *N. acutifolia*, *N. longiflora*, and *N. glauca*; and a prolonged yellowing by *N. quadrivalvis*.

The variety Ambalema and *N. glutinosa* are considered as promising for future breeding work, the object of which should be to select tobacco varieties with an ability to localize the virus.

FOISTER (C. E.). **Descriptions of new fungi causing economic diseases in Scotland.**—*Trans. bot. Soc. Edinb.*, xxxiii, 1, pp. 65–68, 14 figs., 1940.

Technical diagnoses in Latin and English are given of two new fungi causing economic diseases in Scotland, viz., *Phytophthora verrucosa* Alcock & Foister n.sp., causing tomato toe rot [*R.A.M.*, xv, p. 614] and *Phoma foveata* Foister n.sp., causing potato gangrene [ibid., xix, p. 614].

The former is characterized by inversely piriform or oval, terminal or lateral, non-papillate sporangia measuring 31 to 56 by 24 to 36 (average 41·5 to 29·5) μ, with a broadly rounded, slightly thickened hyaline apex and no pedicel, borne on undifferentiated sporangiophores, 15 to 250 μ long. Germination is effected by means of zoospores. Further sporangia are produced usually within, rarely beyond, an empty one by renewed sporangiophore growth. The terminal, rarely lateral, spherical oogonia measure 23 to 47 (average 37) μ in diameter, and usually show a wall 1·7 to 7·7 (4·7) μ thick. The terminal, seldom lateral, antheridia measure 11 to 22 by 10 to 17 (average 16 by 13) μ when paragynous, and 9 to 22 by 8 to 20 (17 by 15) μ when amphigynous. The spherical, hyaline oospores turn light golden-brown with age, measure 17 to 31 (average 24) μ in diameter, and have a wall 3 μ thick. The fungus is parasitic on the roots of cultivated tomato and *Meconopsis* spp.

Phoma foveata shows numerous, isolated or gregarious, subcoriaceous, totally immersed to partially erumpent, irregularly-shaped but mostly globose pycnidia measuring 105 to 309 by 110 to 418 (average 177 by 187) μ, with beak and ostiole absent or indistinct, and with a very solid, dark brown wall with a lining of thin hyaline cells. Commonly situated in pseudo-subicular sheets, the pycnidia are often superimposed, rarely compound. The oblong or ovoid, hyaline, continuous, very rarely bi- to tricellular pycnospores measure 3·2 to 7·7 by 1·1 to 2·1 (average 5·7 by 1·7) μ, are singly borne on simple, very short sporophores, yellow-cream in the mass, and extruded from the pycnidia as globules. Dark brown chlamydospores also occur in chains. The fungus is reported from Great Britain and Northern Ireland. It differs in culture from *P. eupyrena*, *P. solanicola*, and *Phomopsis tuberivora*.

WELLMAN (F. L.) & BLAISDELL (DOROTHY J.). **Differences in growth characters and pathogenicity of Fusarium wilt isolations tested on three Tomato varieties.**—*Tech. Bull. U.S. Dep. Agric.* 705, 28 pp., 2 figs., 5 graphs, 1940.

Out of 127 cultures isolated from wilt-diseased tomatoes in various parts of the United States, 30 were selected for studies on the pathogenicity of the fungus, and of these 29 were definitely identified by Reinking as *Fusarium bulbigenum* var. *lycopersici*, one belonging to another species of the same genus. The organisms were grown on prune, malt, starch, and ordinary and acidified potato dextrose agars, and on Brown's, Leonian's, Richards's modified, soil extract, and Tochinai's [*R.A.M.*, xix, p. 170] liquid media and fell into five distinct cultural groups varying noticeably in their effects on the three tomatoes used in the tests, Red Currant (*Lycopersicum pimpinellifolium*), Marglobe,

and Bonny Best. The most virulent cultures were those with a raised, white mycelium, sometimes flecked with light vinaceous-purple, closely followed by those of a similar colour forming sclerotium-like bodies; a fair amount of infection was produced by the pale vinaceous-grey, intermediate-raised type; the pathogenicity of intermediate-appressed cultures with sparse mycelium over a vinaceous-purple, appressed growth was weaker than the foregoing, while the least injurious were the completely appressed, light vinaceous-grey to slate-purple cultures with no aerial mycelium. Saltation took place in all the classes, being most conspicuous in the raised sclerotial, least so in the fully raised and completely appressed, and intermediate in the transitional groups. The saltants were generally less virulent than the parent cultures.

The fully raised group of cultures produced an average disease evaluation [loc. cit.] on the highly susceptible Bonny Best of 10·39, denoting irreversible injury, the corresponding figures for the raised sclerotial, intermediate-raised, intermediate-appressed, and completely appressed categories being 8·67, 8·34, 6·31, and 4·69, respectively, expressing damage of progressively diminishing intensity. The tolerant Marglobe suffered severe injury from the most virulent cultures (7·50 and 6·25 raised and raised sclerotial, respectively), but proved distinctly resistant to the less pathogenic, while the resistant Red Currant was scarcely affected except by the raised group, and then only mildly (1·42).

Mills (W. R.). **Phytophthora infestans on Tomato.**—*Phytopathology*, xxx, 10, pp. 830–839, 1940.

Tomato foliage is normally resistant to the potato strain of *Phytophthora infestans* [*R.A.M.*, xvii, p. 621], six or seven passages of which from the Green Mountain variety, however, through Bonny Best tomato leaves at the Cornell Agricultural Experiment Station, New York, increased the virulence of the fungus to such an extent that it readily killed tomato plants (Bonny Best, San Mazzano, Allred, and Red Pear). No further access of virulence resulted from additional passages (up to 22) through tomato foliage. A culture of the fungus highly pathogenic to certain potato hybrids [ibid., xvii, p. 482] induced the typical potato strain reactions on tomato foliage prior to seven passages through the latter, after which its virulence towards tomato equalled that of the tomato strain without any loss of infectivity on potato.

Potato leaves were attacked with equal severity by the strains from both hosts, that from tomato retaining its pathogenicity for the original host after three and six months' growth on potato foliage and tubers, respectively. Both strains produced sporangia of equal size on potato leaves and tubers, but the potato strain formed smaller ones than that from tomatoes on tomato foliage, the following dimensions of length having been calculated: strain from potato tuber on potato and tomato, $29{\cdot}34 \pm 0{\cdot}34$ and $29{\cdot}08 \pm 0{\cdot}52\ \mu$, respectively; from potato leaves, $26{\cdot}60 \pm 0{\cdot}39$ and $26{\cdot}14 \pm 0{\cdot}35 \mu$, respectively; from tomato leaves, $24{\cdot}46 \pm 0{\cdot}44$ and $26{\cdot}35 \pm 0{\cdot}40\ \mu$, respectively.

It is concluded from these observations that the tomato strain arises

in nature as a sequel to the serial passage of the potato strain through tomato leaves.

WARD (A. H. O.). **Sleeping disease of Tomatoes.**—*Gdnrs' Chron.*, cvii, 2787, pp. 260–261, 1940.

The writer reports the complete recovery from 'sleepy disease' (*Verticillium*) [*albo-atrum*] in June, 1939, of 22 out of 24 tomato plants in Guernsey, where the disease is very prevalent [cf. *R.A.M.*, xv, p. 690], as a result of transference from the affected glasshouse to pots filled with humus prepared according to the Indore process in a cold house. In March, 1940, five out of six diseased plants similarly treated also recovered.

YOUNG (P. A.). **Soil fumigation with chloropicrin and carbon bisulphide to control Tomato root knot and wilt.**—*Phytopathology*, xxx, 10, pp. 860–865, 1940.

Effective control of tomato wilt (*Fusarium* [*bulbigenum* var.] *lycopersici*) in the very susceptible Greater Baltimore, Stone, and Earliana varieties was obtained at the Texas Agricultural Experiment Station by the application to the soil of chloropicrin [*R.A.M.*, xix, p. 611] at 300 to 600 lb. per acre, which reduced the average incidence of infection from 95 to 9 per cent. Carbon disulphide proved ineffectual for the object in view. Fumigation with chloropicrin at the rate of 10 c.c. per cu. ft. was also efficacious against damping-off fungi (*Pythium* and *Rhizoctonia* spp. [including *Corticium solani*]) in heavily (nearly 100 per cent.) infested soil. Animal glue, casein, and vegetable paste all served equally well as coatings for the paper used for covering treated soil to delay the escape of the fumigants, while practically the same results were secured by wetting the top 2 or 3 in. of the soil with water.

DANA (B. F.). **Occurrence of big bud of Tomato in the Pacific Northwest.**—*Phytopathology*, xxx, 10, pp. 866–869, 3 figs., 1940.

Big bud of tomato [*R.A.M.*, xv, p. 406], a disorder apparently new to the North American continent, developed very sparsely in the Pacific North-west from 1937 to 1939, inclusive, affecting the Marglobe, Dwarf Champion, and Bonny Best varieties and miscellaneous lots of *Lycopersicum* spp. from South America. The branches were abnormally numerous and clumped into witches' brooms, which bore misshapen inflorescences with increased subdivisions and phylloid flowers. Phloem proliferation was consistently associated with these anomalies. Premature and uneven ripening, woodiness of the placental tissue, and poor flavour of the fruit were characteristic of diseased Marglobes in one locality. The disease was transmitted from infected to healthy plants by bud-grafting, but not by means of the juice, with an incubation period of a month. At the same time, phyllody and aggregation of branches occurred on common and Lima beans [*Phaseolus vulgaris* and *P. lunatus*], soy-bean [cf. ibid., xvii, p. 223], lucerne [loc. cit.], sweet clover [*Melilotus*], squash, and carrot, suggesting a possible connexion between big bud of tomato and the similar disturbances of these hosts. In 1937 and 1938 big bud and curly top occurred contiguously in the field, but in 1939 the former was present and the latter

absent. Big bud tends to stimulate vegetative growth and curly top to depress it, besides causing tissue necrosis. Macroscopic symptoms are usually sufficient to differentiate the two diseases, but confirmatory histological comparisons of phloem development are recommended.

HOFFMAN (C. H.) & MOSES (C. S.). **Mating habits of Scolytus multistriatus and the dissemination of Ceratostomella ulmi.**—*J. econ. Ent.*, xxxiii, 5, pp. 818–819, 1940.

Experimental evidence is briefly adduced to show that a single male of *Scolytus multistriatus* contaminated with *Ceratostomella ulmi* [*R.A.M.*, xix, p. 680] may distribute the fungus to several brood burrows on entering them to mate with the females. Of 208 brood burrows containing larvae, 165 (79 per cent.) yielded the pathogen as against only 20 (25 per cent.) of those without them. In these tests the males furnished the sole source of inoculum.

BUCHANAN (W. D.). **Ambrosia beetle, Xylosandrus germanus, transmits Dutch Elm disease under controlled conditions.**—*J. econ. Ent.*, xxxiii, 5, pp. 819–820, 1940.

The ambrosia beetle, *Xylosandrus germanus*, was observed in the field to penetrate into elm logs, felled trees, exposed roots, stumps, and chemically killed trees harbouring the elm disease fungus (*Ceratostomella ulmi*) [see preceding abstract], as well as into similar material free from the pathogen. In 1936, 2 out of 826 (0·24 per cent.) adults collected from the surface of elm trap trees in New Jersey were found to have thus acquired accidental contamination, and experiments were therefore undertaken to determine whether *C. ulmi* could be transmitted by the beetles to healthy logs and trees under favourable conditions. In one test the insects were allowed to migrate freely from a battery jar containing infected elm sections to another occupied by similar healthy material, from which chips were subsequently cultured, the organism being found in 16 out of 94 (17 per cent.), as well as in 3 out of 31 (9·6 per cent.) of the beetles removed directly from the diseased sections into which they had bored. In another experiment the beetles, after being contaminated by *C. ulmi*, were liberated on six healthy five-year-old elm trees (250 per tree), enclosed in muslin cages. The insects made an average of 11·3 holes per tree (all in the trunks), and *C. ulmi* was isolated from five of the trees, only one of which, however, developed the typical symptoms of the disease.

METCALFE (G.). **The watermark disease of Willows. I. Host-parasite relationships.**—*New Phytol.*, xxxix, 3, pp. 322–332, 1 pl., 2 diags., 1940.

In the course of studies at Cambridge, the stained area of a cut two-year-old branch of the cricket-bat willow (*Salix coerulea*), recently affected by the watermark disease [*R.A.M.*, xix, p. 486], was found to consist of three distinct regions, viz., a narrow, black outer zone extending irregularly round the annual ring; a red-brown, waterlogged area between this and the initial parenchyma; and a dark brownish-green, sodden inner zone involving the whole of the wood (with the pith). On exposure to the air the cut surface first turns a bright red-

brown (almost scarlet) and then black. On cutting a thin section from a diseased branch the colours immediately change, the black-stained ring appearing brown and the rest of the affected wood lighter. The black appearance is an optical effect, and there is no real black staining. In branches exceeding 3 in. in diameter the dark ring may be replaced by a circle of discrete patches, or it may take the form of an arc. Branches diseased for over a year may show two or more dark rings or a discoloured centre surrounded by a dark ring.

The bacterial population of the watermarked wood was found to change with time, *Bacterium salicis* being replaced after the first year by three associated organisms, designated A, B, and C, which ultimately permeate all the tissues and completely occlude the vessels, and there is extensive formation by tyloses. The pathological histology of the invaded wood (young and older branches and roots) is fully described, the appearance of the latter resembling that of the shoots.

Infection of the outer elements of the new annual ring takes place in the late summer by way of the holes bored by insect larvae, but inoculation experiments showed that there is no active spread of the organisms between May and September. Following the hydrolysis of starch in March and the consequent appearance of high concentrations of food materials in the sap, the bacteria become actively motile and multiplication is so rapidly effected that within a month a new disease zone has been formed throughout the tree, both above and below ground, the vessels being blocked and oil accumulating in the ray cells, which are impregnated with a brown stain. From May onwards there is a progressive re-invasion of the wood of the innermost diseased annual ring by secondary bacteria, probably originating in the roots: at this stage *Cytospora chrysosperma* gains ingress to the wood and rapidly extends as the branch dies. Early in the summer, therefore, a two-year-old branch that has been diseased for one year begins to assume the typical January aspect of a branch infected for two years, and by the end of August this transition is almost complete. At this time, however, the current year's wood seems to be free from bacteria, a thin wall-layer of which only becomes noticeable in the outermost vessels in the autumn.

The small cracks formed by the solution of the middle lamellae of the walls in the disease zone are attributed to the pectin-utilizing properties (experimentally demonstrated) of bacterium C, which enters by way of the pit membranes. During their spread along the middle lamellae, the organisms come into contact with healthy vessels and ray cells, which in turn are colonized. By means of this tangential diffusion within an annual ring, the bacteria are able to penetrate the wood connected with branches the point of insertion of which lies above or below that of the original site of attack.

LUTTRELL (E. S.). **Morenoella quercina, cause of leaf spot of Oaks.**—*Mycologia*, xxxii, 5, pp. 652–666, 13 figs., 1940.

A leaf spot of oaks caused by *Morenoella quercina* is widely present throughout the south-eastern area of the United States. In the Duke Forest the condition affects the red oaks *Quercus borealis* var. *maxima*,

Q. velutina, *Q. marilandica*, *Q. coccinea*, *Q. rubra*, and *Q. phellos*, though the white oaks *Q. alba* and *Q. stellata* appear to be immune. In other localities the disease occurs on *Q. rubra*, *Q. pumila*, *Q. myrtifolia*, and also on the white oaks *Q. geminata*, *Q. virginiana*, *Q. virens*, *Q. minima*, *Q. chapmani*, and *Q. stellata*.

The disease is most apparent on young trees, on the leaves of which small, blackened areas appear in early summer, somewhat resembling injuries caused by sucking insects. Characteristic mycelium is, however, present on the upper leaf surface. In September, the spots increase in size to a centimetre or more in diameter. Circular and purplish-black on the upper surface, they appear as irregular, brownish areas on the lower. They may become confluent and cover most of the leaf surface. Affected leaves do not fall prematurely, but photosynthesis is impaired, and severe infection over a period of several seasons reduces the vitality of seedlings. The condition is not of appreciable importance on older trees.

The nomenclature of the causal organism is briefly reviewed and the name *M. quercina* (Ellis and Martin) Theissen accepted; the fungus is regarded as belonging to the group Ascoloculares, as delimited by Nannfeldt [*R.A.M.*, xi, p. 606]. It is a superficial parasite depending in its early development on nutrients absorbed through the intact host cuticle. The hyphae subsequently penetrate the cuticle to form a subcuticular mycelium. The external mycelium may produce toruloid hyphal fragments functioning as conidia. A spermogonial stage, not hitherto recorded, is described. When mature the spermogonium is hemispherical with a basal wall lacking, the floor being occupied with a layer of large hyaline spermatiophores. Each cell is ampulliform and abstricts hyaline spermatia, 6·4 by 1·3 μ. Spermogonia and ascocarp initials appear concurrently on the same external mycelium before the leaves are shed, the ascocarps continuing to develop on the fallen leaves and reaching maturity in spring. The ascocarp is a flat stroma consisting of a pseudoparenchymatous, radiate shield arising from a segment of a single hypha, and of a plectenchymatous fertile layer under the shield. The asci arise singly within the stroma, the intervening sterile tissue becoming absorbed, and the covering shield splitting to expose the mature asci. These are short, cylindrical, and broadly rounded at the apex, about 27 by 10 μ, and contain bicellular, ultimately dark brown ascospores, 12 to 14 by 5 to 6 μ.

HATTORI (T.) & TAMURA (T.). **The effect of electric current on the growth of fungi.**—*Electrotech. J., Tokyo*, iv, 3, pp. 58–63, 3 figs., 4 diags., 1940.

Most of the information contained in this detailed description of the writers' experiments on the effect of electric currents on fungal growth, the object of which was to devise a method of prolonging the life of timber on the Imperial (Japanese) Government Railways, has already been noticed from another source [*R.A.M.*, xix, p. 379], but it may be of interest to mention that the woods used for the tests were *Pinus densiflora* (for *Poria vaporaria*) and *Fagus sieboldii* for *Schizophyllum commune* and *Polystictus sanguineus*.